5 Valued Components

5.1 Atmospheric Environment

The Atmospheric Environment VC considers air quality, (GHG) emissions, and the acoustic environment (i.e., noise). This VC was selected for consideration in the assessment of Project-related environmental effects due to the following:

- The importance of air quality to the health and wellbeing of human and non-human biota
- The importance of the atmospheric environment as a pathway for the potential transport of Project related air contaminants (including dust) to surrounding terrestrial, freshwater, and human environments
- Human activities, mainly through emissions of GHGs, and their accumulation in the atmosphere on a worldwide scale over time, have caused climate change (IPCC 2023)
- The potential for Project-related noise to cause sensory disturbance affecting human health and wellbeing, land and resource use, and wildlife and wildlife habitat.

Activities associated with the Project can adversely affect air quality, GHG emissions, and the acoustic environment. A significant residual adverse effect on Atmospheric Environment is defined as any of the following:

- For air quality, the Project-related maximum ground level concentrations of air contaminants released plus the background levels result in frequent exceedances of applicable ambient air quality objectives, guidelines or standards. Frequency is defined as once per week for one-hour objectives and once per month for 24-hour objectives.
- The significance of Project GHG emission totals will be determined as compared to the provincial and federal GHG reduction totals by comparing Project GHG emission estimates to provincial and national GHG annual emissions and established reduction targets. Project emissions will be classified as low, moderate, and high.
  - Low is defined as 10,000 tonnes (t) of carbon dioxide equivalent (CO_2e) or less per year. Projects emitting less than 10,000 t CO_2e per year are not required to report their GHG emissions to Environment and Climate Change Canada’s (ECCC) Greenhouse Gas Reporting Program (GHGRP) and therefore, are considered small, with emissions that are not substantive.
  - Moderate is defined as emissions contributing 10-25% to provincial/federal GHG emissions totals, or 10-25% in comparison to provincial GHG reduction targets.
  - High is defined as emissions contributing more than 25% to provincial/federal GHG emissions totals, or more than 25% in comparison to provincial GHG reduction targets.

- For the acoustic environment, Project-related noise from Project activities plus the background sound pressure levels would cause exceedances of applicable noise guidelines or would result in exceedances of local noise by-laws.

5.1.1 Existing Conditions

5.1.1.1 Approach and Methods

To characterize the existing conditions for the Atmospheric Environment, the following sources of information were reviewed:

- Provincial and national GHG emissions data published by ECCC in annual National Inventory Reports, and data pertaining to existing emissions of GHGs in Nova Scotia, acquired from the federal GHGRP
- Existing ambient air quality data from the provincial and federal ambient air monitoring networks, as published by NSECC and ECCC, as well as data on existing emissions from other sources located near the Project

Noise monitoring at nearby receptor locations was completed to characterize the existing acoustics environment.

5.1.1.2 Description of Existing Conditions

5.1.1.2.1 Air Quality

Air quality in the province of Nova Scotia is regulated by the *Environment Act* and the Air Quality Regulations by providing maximum permissible ground-level concentrations of specified air contaminants, among other requirements. The Air Quality Regulations are under review, and the provincial government has developed proposed ambient air quality standards based on global health guidance (NSECC 2022). The current and proposed limits for air contaminants are presented in Table 5.1.1.

Table 5.1.1 Nova Scotia Air Quality Standards

Air Contaminant	Averaging Period	Air Quality Regulations, Schedule A ($\mu g/m^3$)	Proposed Ambient Air Quality Standards ($\mu g/m^3$)[1]
Carbon Monoxide (CO)	1 hour	34,600	35,000
	8 hours	12,700	10,000
Hydrogen Sulphide (H_2S)	1 hour	42	-
	24 hours	8	-
Total Reduced Sulphur (TRS)*	24 hours	-	7
Nitrogen Dioxide (NO_2)	1 hour	400	200
	24 hour	-	25
	Annual	100	10
Ozone (O_3)**	1 hour	160	-
Sulphur Dioxide (SO_2)	1 hour	900	-
	24 hours	300	40
	Annual	60	-
Total Suspended Particulate (TSP)	24 hours	120	100
	Annual	70***	60
$PM_{2.5}$	24 hours	-	15
	Annual	-	5
PM_{10}	24 hours	-	45
	Annual	-	15

Notes:
* TRS has been selected to replace H_2S as it is considered a better measure of the total impact of reduced sulphur compounds. TRS includes the measurement of H_2S but also includes other related compounds (NSECC 2022).
** O_3 is no longer included in the proposed ambient air quality standards because no activity emits ozone; it is a secondary pollutant formed through photochemical reactions involving primary chemicals (NSECC 2022).
*** geometric mean
$\mu g/m^3$ = micrograms per cubic metre
$PM_{2.5}$ = particulate matter with particles less than 2.5 micrometres in diameter
PM_{10} = particles less than 10 micrometre in diameter
Source: NSECC 2022

At the federal level, the Canadian Ambient Air Quality Standards (CAAQS), developed by the Canadian Council of Ministers of the Environment (CAAQS 2024), provide guidance for managing the release of air contaminants. The CAAQS standards are presented in Table 5.1.2.

Table 5.1.2 Canadian Ambient Air Quality Standards

Air Contaminant	Averaging Period	parts per billion (ppb)	µg/m³
Ozone (O_3)	8 hours	60	118
Nitrogen Dioxide (NO_2)	1 hour	42	79
	1 year	12	23
Sulphur Dioxide (SO_2)	1 hour	65	170
	1 year	4	10
$PM_{2.5}$	24 hours	-	27
	1 year	-	8.8

Notes:

The CAAQS includes standards for 2015, 2020 and 2025; the 2025 standards are listed above, except for fine particulate matter since there is no 2025 standard available. The 2020 standard for fine particulate matter is presented above.

Metrics for each measured parameter:

$PM_{2.5}$ (24 hour) 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual) 3-year average of the annual average concentrations
O_3 (8 hour) 3-year average of the annual 4th highest maximum 8-hour average concentrations
SO_2 (1 hour) 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
SO_2 (annual) Arithmetic average over a single calendar year of all the SO_2 1-hour average concentrations during the year
NO_2 (1 hour) 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations
NO_2 (annual) Arithmetic average over a single calendar year of all the NO_2 1-hour average concentrations during the year
Source: CCME 2017

The Canadian Council of Ministers of the Environment also developed the Air Quality Management System (AQMS), which is a framework to aid in the reduction of emissions and ambient concentrations of pollutants of concern (CCME 2017). The AQMS categorizes air quality management into four levels. Each management level corresponds to a range of concentrations of air contaminants, which were established during the development of the CAAQS (CCME 2017). The management levels are as follows:

- Red Management Level, to reduce pollutant levels below the CAAQS through advanced air management actions
- Orange Management Level, to improve air quality through active air management and prevent exceedances of the CAAQS
- Yellow Management Level, to improve air quality using early and ongoing actions for continuous improvement
- Green Management Level, to maintain good air quality through proactive air management measures to keep clean areas clean

The Province of Nova Scotia publishes air zone reports annually, which compare ambient air quality monitoring results to the AQMS and CAAQS. The 2022 air quality monitoring results from the Kentville and Downtown Halifax stations, which are the closest stations to the Project, are presented in Table 5.1.3 and Table 5.1.4 (NSECC 2022; NSECC 2024). The Kentville station is approximately 40 kilometres north north-west of the Project, and the Downtown Halifax station is approximately 45 kilometres southwest from the Project.

Table 5.1.3 Air Quality Results at the Kentville Air Monitoring Station (2017 – 2022)

Reporting Year	Ozone (O_3) 8-hour (ppb)	$PM_{2.5}$ 24-hour (µg/m³)	$PM_{2.5}$ annual (µg/m³)	Nitrogen Dioxide (NO_2) 1-hour (ppb)	Nitrogen Dioxide (NO_2) Annual (ppb)
2017	60*	11*	5.5*	-	-
2018	59*	12	6.1	-	-
2019	58*	12	6.3	-	-
2020	53*	12	6.0	10	1.0
2021	50*	12	5.4	9	0.9
2022	50*	13	5.4	10	1.0
Air Quality Criteria					
Air Quality Regulations, Schedule A	-	-	-	400	100
Proposed Ambient Air Quality Standards**	-	15	5	200	10
CAAQS 2025	60	27***	8.8***	42	12

Notes:
µg/m³ micrograms per cubic meter
ppb parts per billion
\- not available
* Value calculated from two years of data instead of three
** The Nova Scotia Proposed Ambient Air Quality Standards
*** The CAAQS 2025 do not have a criterion for $PM_{2.5}$, so the 2020 criterion is shown
Green Indicates parameter is in the green air zone management level range, meaning air quality is good and can be maintained through proactive air management measures to keep clean areas clean
Yellow Indicates parameter is in the yellow air zone management level range, meaning air quality could be improved using early and ongoing actions for continuous improvement
Orange Indicates parameter is in the orange air zone management level range, meaning air quality could be improved through active air management and preventing exceedances of CAAQS
Source: CCME 2017; NSECC 2022; NSECC 2024

The air contaminant concentrations measured at the Kentville station have been within the same management levels since 2017, except for O_3, which has improved over time. The measured concentrations of O_3 (8-hour) and NO_2 (1-hour and annual) are in the green management level and are also below the maximum permissible ground-level concentrations set out by the provincial Air Quality Regulations and proposed ambient air quality standards, and CAAQS. The concentrations of $PM_{2.5}$ (24-hour and annual) are yellow (meaning air quality could be improved using early and ongoing actions for continuous improvement). For $PM_{2.5}$ (24-hour), the air quality criteria set out by the Nova Scotia proposed ambient air quality standards and CAAQS have not been exceeded. For $PM_{2.5}$ (annual), the air quality criteria set out by the Nova Scotia proposed ambient air quality criteria have been exceeded, but the measured levels are below the CAAQS.

Table 5.1.4 Air Quality Results at the Downtown Halifax Air Monitoring Station (2017-2022)

Reporting Year	Ozone (O3) 8-hour (ppb)	PM2.5 24-hour (µg/m3)	PM2.5 annual (µg/m3)	Sulphur Dioxide (SO2) 1-hour (ppb)	Sulphur Dioxide (SO2) Annual (ppb)	Nitrogen Dioxide (NO2) 1-hour (ppb)	Nitrogen Dioxide (NO2) Annual (ppb)
2017	43	12	5.2	-	-	-	-
2018	46	12	5.6	-	-	-	-
2019	47	12	5.6	-	-	-	-
2020	48	11	5.4	8	0.3	28	4.6
2021	49	11	5.3	9	0.4	26	4.9
2022	51	12	5.4	13	0.4	28	5.0
Air Quality Criteria							
Air Quality Regulations, Schedule A	-	-	-	900	60	400	100
Proposed Ambient Air Quality Standards*	-	15	5	-	-	200	10
CAAQS 2025	60	27**	8.8**	65	4	42	12

Notes:
$\mu g/m^3$ micrograms per cubic meter
ppb parts per billion
- not available
* The Nova Scotia Proposed Ambient Air Quality Standards
** The CAAQS 2025 do not have a criterion for $PM_{2.5}$, so the 2020 criterion is shown
Green Indicates parameter is in the green air zone management level range, meaning air quality is good and can be maintained through proactive air management measures to keep clean areas clean
Yellow Indicates parameter is in the yellow air zone management level range, meaning air quality could be improved using early and ongoing actions for continuous improvement
Source: CCME 2017; NSECC 2022; NSECC 2024

The air contaminant concentrations measured at the Downtown Halifax station are in the yellow and green management levels. The concentrations of O_3 (8-hour), were in the green management level from 2017 to 2021, and decreased to the yellow management level in 2022. The measured O_3 concentrations do not exceed CAAQS. The concentrations of $PM_{2.5}$ (24-hour and annual) and NO_2 (1-hour and annual) are in the yellow management level and are below the provincial and federal air quality criteria except for $PM_{2.5}$ (annual), which is slightly above the proposed ambient air quality standards. The measured concentrations of SO_2 (1-hour and annual) are in the green management level and are below the provincial Air Quality Regulations and proposed ambient air quality standards, and CAAQS.

5.1.1.2.2 Greenhouse Gases

Provincially, industrial facilities are required to report and verify GHG emissions under the Quantification, Reporting and Verification Regulations if the facility releases a minimum of 50,000 t CO_2e per year. There are also reporting and verification requirements for natural gas distributors and petroleum product suppliers. The Province has committed to reducing GHG emissions; the *Environmental Goals and Climate Change Reduction Act* sets the following GHG reduction targets:

- reduce GHG emissions by 53% below 2005 levels by 2030
- achieve net-zero GHG emissions by 2050.

Federally, industrial facilities that emit 10,000 t CO_2e or more per year during operation are required to report GHG emissions to the ECCC GHGRP. The federal government's Emissions Reduction Plan aims to reduce emissions in Canada by 40-50% below 2005 levels by 2030 (Government of Canada 2023a). The federal government has also committed to achieving net-zero emissions by 2050 (Government of Canada 2024).

In 2022 (the most recently published data from Canada's National Inventory Reports), Canada's GHG emissions were 707,767 kilotonnes (kt) of CO_2e, of which 14,776 kt CO_2e were released in Nova Scotia (ECCC 2024b). Therefore, Nova Scotia's GHG emissions were approximately 2% of Canada's emissions in 2022. A summary of Nova Scotia's GHG emissions over the last five years is presented in Table 5.1.5.

Table 5.1.5 Nova Scotia's GHG Emissions by Industry (2018-2022)

Industry Category		kilotonnes CO_2e by year				
		2022	**2021**	**2020**	**2019**	**2018**
Energy	Stationary Combustion	7,833	8,010	8,307	8,872	9,403
	Transport	5,492	5,260	4,923	5,807	5,579
	Fugitive Sources	54	63	151	196	145
	Total Energy	**13,379**	**13,334**	**13,381**	**14,875**	**15,128**
Industrial Processes		468	466	478	447	447
Agriculture		341	341	344	338	346
Waste		588	580	568	549	525
Total		**14,776**	**14,721**	**14,771**	**16,208**	**16,475**

Source: ECCC 2024b

GHG emissions in Nova Scotia have been declining (16,475 kt CO_2e in 2018 compared to 14,776 kt CO_2e in 2022). Similarly, Canada's GHG emissions have also been on the decline over the last five years (752 631 kt CO_2e in 2018 compared to 707,767 kt CO_2e in 2022) (ECCC 2024b).

ECCC's GHGRP collects and reports GHG emissions data form facilities across Canada on an annual basis; this is a mandatory program for facilities that emit over 10,000 t CO_2e per year. In 2022 (the most recently published data from the GHGRP), the largest emitting facility in Nova Scotia was the Lignan Generating Station, with over 2 million t CO_2e (14% of Nova Scotia's total GHG emissions) (Government of Canada 2023b).

5.1.1.2.3 Acoustic Environment

Noise is regulated in Nova Scotia through consideration of the Guidelines for Environmental Noise Measurement and Assessment published by Nova Scotia Environment and Climate Change (Noise Guidelines) (NSECC 2023). The Noise Guidelines include permissible sound levels that depend on the population density of the area and on the time of day. There are no local municipal bylaws related to noise for the Project location.

The receptor locations in Newport Station are considered to be a rural geographic classification based on the estimated population density for the area The rural permissible sound levels for receptors near the Project based on the NoiseGuidelines are as follows:

- 53 dBA between 07:00 and 19:00
- 48 dBA between 19:00 and 23:00
- 40 dBA between 23:00 and 07:00

If the baseline noise level is found to be in exceedance or is within 5 dB of the permissible sound level, then an alternative permissible sound level can be used as per Appendix 1 of the Noise Guidelines.

Impulsive noise, such as noise from blasting, is also addressed in the Noise Guidelines and depends on the number of impulsive events that occur over a 1-hour period. Blasting is expected to occur once or twice a year, and so the Noise Guidelines indicate that impulsive noise from blasting should not exceed 128 dBAI.

Baseline monitoring was completed in October 2024 near the PDA to measure existing noise levels at nearby receptor locations. The location where baseline monitoring occurred is shown in Figure 5.1.1. Noise monitoring occurred during periods of low wind and no rain. Several wildlife sounds were occurring during the monitoring campaign. Since these wildlife sounds were not considered to be representative of the area during most of the year, these wildlife calls were filtered from the noise measurement data analysis and reporting.

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend
- Noise Monitoring Location
- Project Development Area (PDA)
- Transmission Line
- Arterial
- Local Road
- Resource Road / Trail
- Railroad
- Watercourse
- Waterbody

0 100 200 300 400 500 Metres
(At original document size of 8.5x11)
1:15,000

N

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by AC on 2025-03-26

Client/Project
Spence Aggregates Limited
Spence Quarry Expansion

121418141

Figure No.
5.1.1

Title
Noise Monitoring Location

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A summary of the baseline noise levels near the PDA are shown in Figure 5.1.2. Noise levels in the region are representative of a rural area, with noise levels measured as low as 39 dBA during the daytime and 31 dBA during the night. There were some instances where the baseline conditions exceeded the Noise Guideline levels; however, those were associated with offroad vehicles in the area on October 14, 2024.

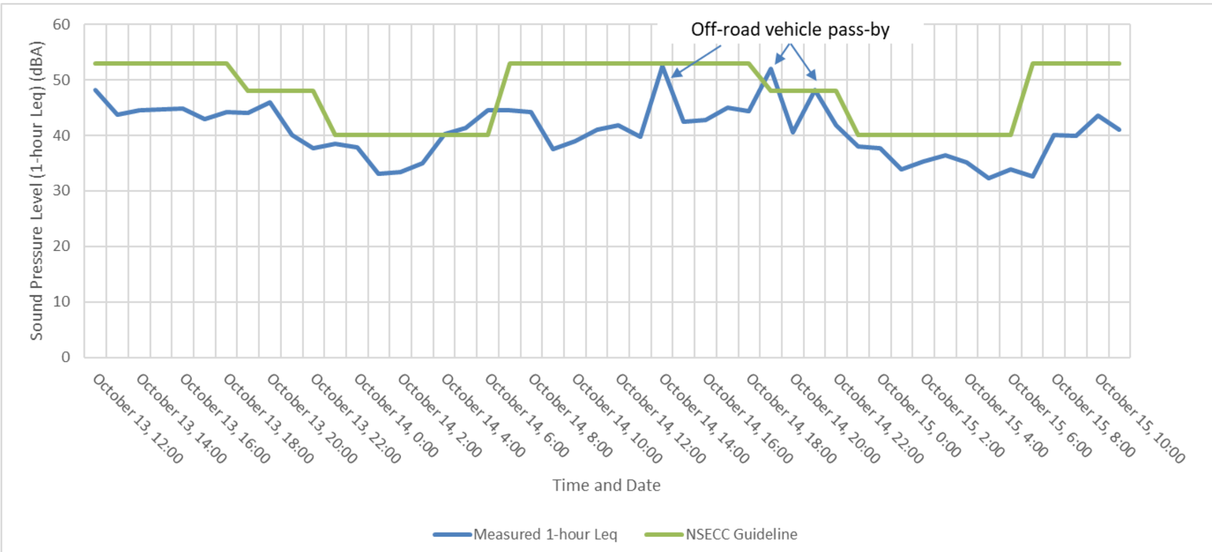


Figure 5.1.2 Measured 1-Hour Leq Sound Pressure Level Compared to NSECC Noise Guideline Criteria

5.1.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Atmospheric Environment is provided in Table 5.1.6. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.1.6 Potential Effects, Effect Pathways and Measurable Parameters for Atmospheric Environment

Potential Effect	Effect Pathways(s)	Measurable Parameter(s)
Change in Air Quality	• Interactions between activities and the environment that result in direct effects to the quality of the ambient (outdoor) air.	• Concentrations (μg/m^3) of carbon monoxide (CO); total reduced sulphur (TRS), nitrogen dioxide (NO_2), ozone (O_3), sulphur dioxide (SO_2), total suspended particulate matter (TSP), $PM_{2.5}$ and PM_{10}.
Change in GHGs	• Interactions between activities and the environment that result in increased GHG emissions.	• Emissions (tonnes per year) of carbon dioxide equivalent (CO_2e).
Change in Acoustic Environment	• Interactions between activities and the environment that result in changes to the existing acoustic environment.	• Change in sound pressure levels (1-hour L_{eq}, dBA).

The Project will interact with the Atmospheric Environment resulting in a change in air quality, change in GHGs, and change in acoustic environment from the following activities:

- Operation of heavy equipment and light and heavy-duty trucks fueled by diesel and gasoline
- Movement of vehicles on unpaved roads generating fugitive dust
- Operation of a crusher and/or screener for crushing and screening aggregate, generating fugitive dust

5.1.3 Mitigation and Management Measures

The following mitigation measures specific to Atmospheric Environment have been identified for the Project:

- Equipment will be maintained in good working order, in adherence to manufacturer’s recommended schedules.
- Idling of equipment will be reduced to the extent practical.
- Haul distances to disposal sites will be reduced to the extent practical .
- Disturbed areas will be revegetated as soon as practical to limit dust emissions.
- Fugitive road dust will be controlled with measures such as road watering and application of calcium chloride on an as-needed basis and speed limits on Project-controlled gravel roads.
- Quarrying activities will be limited to daytime hours to the extent practical to limit nuisance noise to off-site receptors at night.
- Crushing equipment will be operated on the quarry floor, largely below ground level which reduces noise and dust in the areas located above ground.
- Blasting will be monitored and will be conducted in accordance with issued permits.

Design mitigation and standard best management practices will also be implemented to avoid or reduce potential effects on Atmospheric Environment.

5.1.4 Residual Environmental Effects

5.1.4.1 Change in Air Quality

Air contaminants will be released from the operation of construction equipment, machinery, trucks, and the generation of dust. During quarry operations, air contaminants are expected to be released from the operation of trucks, and fugitive dust will be generated from the crushing and screening of aggregate. Air contaminants released during reclamation and abandonment are expected to be similar to, or less than, the emissions associated with clearing and grubbing activities associated with site preparation. Since the proposed Project is not anticipated to result in changes to current quarry operations, the release of air contaminants from the Project are not expected to differ substantively or contribute measurably to existing ambient air quality. With the application of the mitigation and management measures described in section 5.1.3, Project related releases of air contaminants are not expected to cause exceedances of provincial or federal air quality objectives, guidelines or standards.

5.1.4.2 Change in Greenhouse Gases

GHGs are expected to be released from the operation of diesel-fueled equipment, machinery, and trucks throughout the life of the Project. Project-related releases of GHGs are expected to be in the range of low (10,000 t CO_2e or less per year) to moderate (10,000 to 100,000 t CO_2e per year), but not high (over 100,000 t CO_2e per year).

5.1.4.3 Change in Acoustic Environment

Quarry activities will be limited to daytime hours as feasible to limit nuisance noise to off-site receptors at night. Noise emissions will be generated through the operation of equipment, machinery, and trucks; blasting; aggregate hauling; and crushing; and screening. Aggregate hauling is planned to occur along Stark Road and Pleasant Street, both of which are roads that are classified to allow heavy equipment transport.

Blasting is expected to occur once or twice per year, maintaining the same frequency of blasting as existing operations. Blast energy reaching the atmosphere can generate impulsive noise. Blasting will be limited to daytime hours and will follow best management practices, such as those outlined in guidance documents such as the Blasters Handbook (ISEE 2016), which provide detailed information on designing and carrying out blasting to reduce sound emissions. It is therefore expected that blasting will comply with impulsive noise criteria outlined in the Noise Guidelines.

Noise emissions from earthmoving, crushing and screening were incorporated in an acoustic model to estimate the impact to the acoustic environment on nearby receptors. Cadna/A is a commercial environmental noise modeling application that follows methodologies outlined in ISO 9613 for computing sound pressure levels in the environment.

It is expected that operations will include up to two loaders and one excavator, in addition to aggregate crushing and hauling of material on site. A summary of the sound power levels for the noise-generating equipment included in the noise model is provided in Table 5.1.7.

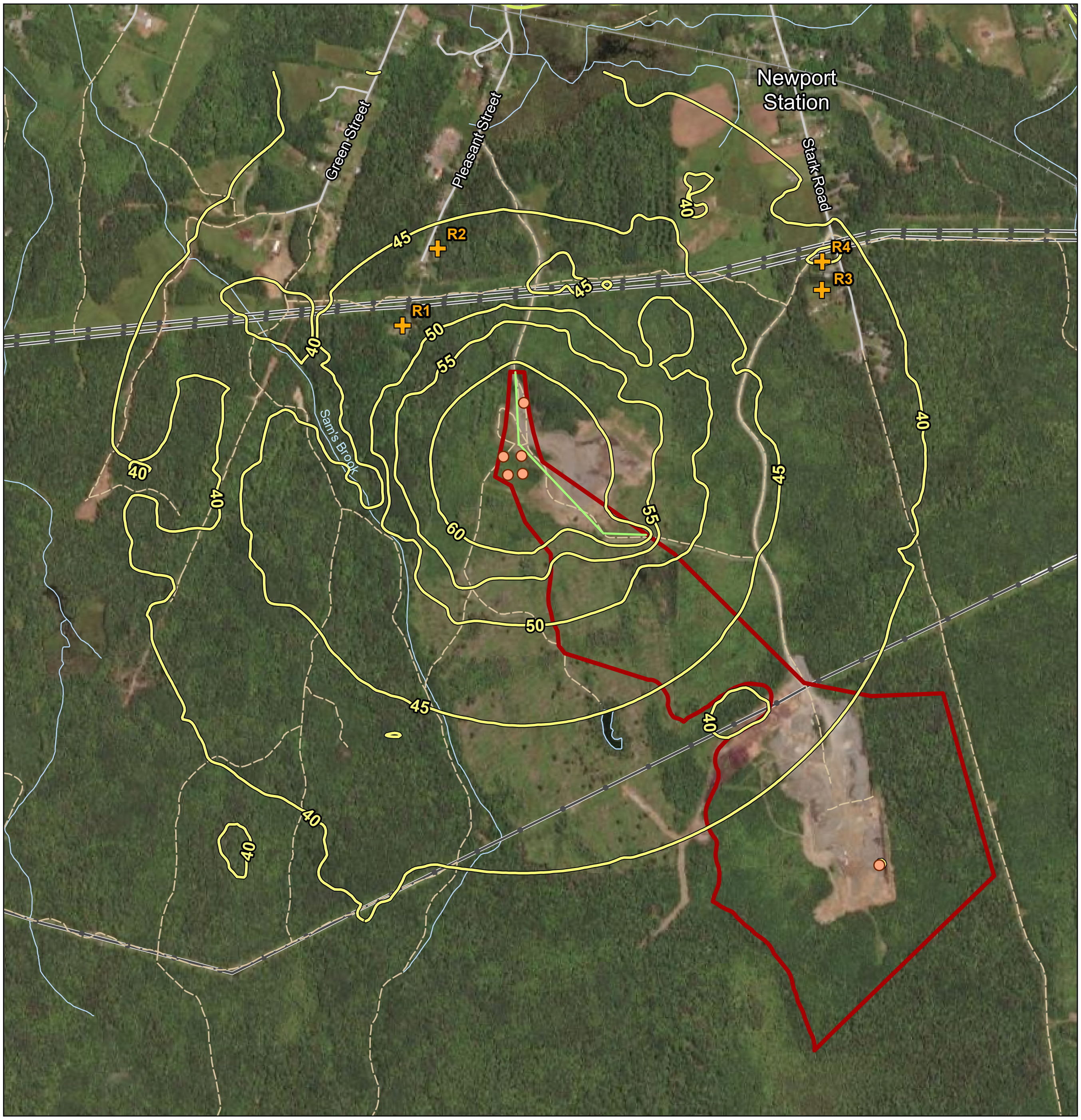
Table 5.1.7 Summary of Sound Power Levels used for Operations Equipment

Equipment	Description	Sound Power Level (dB) by Octave Band (Hz)								Total Sound Power Level	
		63	125	250	500	1000	2000	4000	8000	dB	dBA
Volvo L110 H	Loader	116	112	109	112	104	98	96	89	119	111
Volvo L150	Loader	116	112	109	112	104	98	96	89	119	111
Ingersoll Rand Model: Light Source A generator	Generator	106	99	94	90	87	83	84	77	107	93
Volvo 380	Excavator	110	115	110	105	100	98	94	87	118	108
Hauling Truck	Truck Pass-by	120	121	116	113	113	111	107	101	127	118
Crushing Equipment	Crushing Activities	111	111	110	107	103	101	96	81	117	109

The predicted sound pressure levels from activities occurring within the PDA is shown in Figure 5.1.3. A summary of the total sound pressure level at the nearby receptor locations due to Project activities at nearby receptors is summarized in Table 5.1.8. The Project noise levels were compared against the daytime permissible sound levels in the Noise Guidelines since operations are not expected to occur during the evening or nighttime. Noise from Project operations is predicted to comply with the Noise Guidelines level of 53 dBA.

Table 5.1.8 Summary of Baseline, Project-Related, and Total Sound Pressure Levels at Nearby Receptor Locations

Receptor	Baseline Daytime Sound Pressure Level (dBA)	Predicted Daytime Sound Pressure Level (dBA)	Total Daytime Sound Pressure Level (dBA)	Nova Scotia Noise Guideline Level (dBA)
R1	39	48.5	49	53
R2		46.0	47	
R3		41.6	44	
R4		39.2	42	



Legend

- Nearby Noise Receptor
- Stationary Sources (Loaders, Excavator, and Crushing)
- Sound Pressure Level (dBA)
- Haul Route
- Project Development Area (PDA)
- Transmission Line
- Arterial
- Local Road
- Resource Road / Trail
- Railroad
- Watercourse
- Waterbody

0 100 200 300 400 500 Metres

(At original document size of 8.5x11)
1:15,000

N

Stantec

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Project Location
Spence Quarry
Windsor, NS

Prepared by AC on 2025-03-26

Client/Project
Spence Aggregates Limited
Spence Quarry Expansion

121418141

Figure No.
5.1.3

Title
Predicted Sound Pressure Level Contours from Project Operations

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5.1.4.4 Summary

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial interaction between the Project and air quality, GHGs or the acoustic environment (section 5.1.4). The releases of air contaminants from the Project are not expected to cause exceedances of provincial or federal air quality objectives, guidelines or standards. The releases of GHGs from Project activities are not expected to result in material changes in provincial and national GHG emissions. Project-related noise levels are not predicted to exceed Nova Scotia permissible sound levels for nearby receptors as per the Noise Guidelines. The residual environmental effects on the Atmospheric Environment are predicted to be not significant for the Project.

5.1.5 Follow-up and Monitoring Programs

Follow-up and monitoring are intended to verify the accuracy of predictions made during the EA, to assess the implementation and effectiveness of mitigation, and to manage adaptively, if required. Compliance monitoring for particulate emissions and noise will be conducted, when required by regulators, to confirm that mitigation measures are properly implemented. Blasting monitoring will occur in accordance with issued permits. Should an unexpected deterioration of the environment be observed as part of follow-up and/or monitoring, intervention mechanisms may include the application of mitigation measures to address it.

5.2 Groundwater Resources

Groundwater Resources was selected as a VC because of its importance to ecosystem function, potential Project-related interactions with human uses, and provisions of the Nova Scotia Pit and Quarry Guidelines. Groundwater resources are critical in maintaining baseflow to streams for ecological habitat, and in supplying fresh water for human and industrial/commercial uses. Groundwater quantity and quality could be affected by the construction, operation, rehabilitation, and closure of the Project, which may in turn affect surface water and fish habitat. For this assessment, the Groundwater Resources VC is defined as the value and function of groundwater resources in maintaining baseflow to streams for ecological habitat, and in supplying fresh water for human and industrial/commercial uses.

In addition to Nova Scotia's Environmental Assessment Regulation, the Project is subject to other federal and provincial legislation, policies, and guidance related to groundwater resources. This section identifies the primary regulatory requirements and policies which influence the management of groundwater resources in Canada and Nova Scotia.

The Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) are established by the Canadian Council of Ministers of the Environment (CCME). These guidelines are developed collaboratively among provincial, territorial, and federal jurisdictions and regularly updated to reflect current toxicology information and guideline derivation approaches.

The Guidelines for Canadian Drinking Water Quality (GCDWQ) are established by Health Canada (2025). These guidelines are developed with the Federal-Provincial-Territorial Committee on Drinking Water. GCDWQ are applicable as aesthetic and health-based guideline for a variety of chemical and physical parameters for potable water sources within the PDA.

The *Environment Act*, enforced by NSECC, supports the preservation, management, and sustainable use of environmental resources in Nova Scotia. Within the *Environment Act* there are regulations to protect the aquatic environment, including the environmental assessment process, release of substances, dangerous goods, waste management, water resource management, and pit and quarry guidelines.

5.2.1 Existing Conditions

A characterization of the existing conditions within the PDA is provided in the following sections. This includes a discussion of the influences of physical activities on the VC, leading to current conditions. An understanding of the existing conditions for the VC within the PDA is a key requirement in the prediction of potential Project effects discussed in section 5.2.4.

5.2.1.1 Approach and Methods

Information regarding existing conditions of groundwater resources in the PDA are derived from data collected in support of the existing quarry, data collected in support of the quarry expansion, and existing, publicly available regional hydrogeological information. The data span a period of 1979 through to 2020. The following data and reports were reviewed to characterize existing conditions for groundwater resources for the Project:

- Canadian Climate Normals, 1991 – 2020 (ECCC 2024b)
- Geological/hydrogeological mapping information from AR ME (1980), Kennedy and Drage (2008), Kennedy and Drage (2009), Keppie (2000), Moore et al. (2009), Stea et al. (1992)
- Nova Scotia Groundwater Chemistry Database (NSDNRR 2025)
- Nova Scotia Well Logs Database (NSECC 2025)

Based on publicly available data, there are no known existing wells within the PDA to confirm water table levels. Water level and water quality data were not available for the PDA.

5.2.1.2 Description of Existing Conditions

Groundwater is an integral component of the hydrologic cycle that originates from the infiltration of precipitation or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures and other void spaces, which have developed in consolidated materials. Within the sub-surface, the upper surface of the saturated zone is called the water table. Where the water table intersects the ground surface, interaction between groundwater and surface water can occur. In general, groundwater flows through soil, glacial overburden, and bedrock from areas of high elevation (i.e., recharge areas) to areas of low elevation (i.e., discharge areas) where it discharges from the sub-surface to springs, streams, and lakes. Groundwater generally sustains the baseflow of streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under certain hydrogeological conditions.

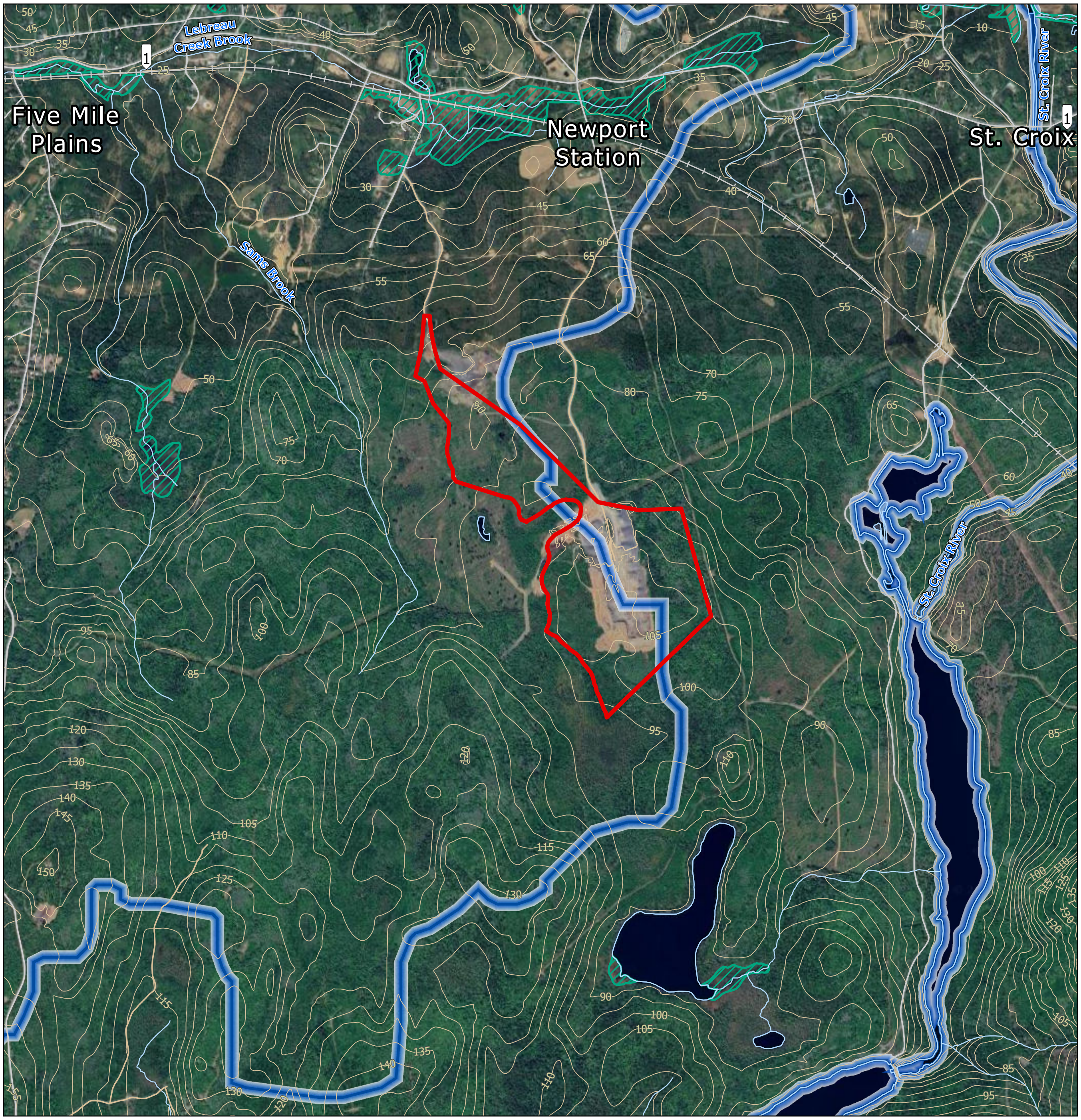
An aquifer is a geological formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. The yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers into which the wells are constructed. Within an aquifer, the natural groundwater quality is directly influenced by the geochemical composition of the sub-surface materials through which the water passes, and the time the water resides within those materials.

The following sections provide descriptions and characterizations of the environmental setting of the Project as it relates to local and regional hydrogeology of the area.

5.2.1.2.1 Physiography and Drainage

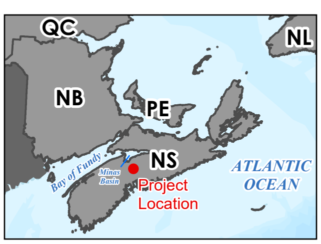
Elevations within the PDA range from approximately 110 metres above sea level (masl) to 65 masl. The topography and surface water features near the site are illustrated in Figure 5.2.1.

Surface water in the PDA is expected to follow local topography. Based on topographic maps (Figure 5.2.1), the PDA is inferred to straddle a sub-watershed divide, with local surface flow for most of the PDA expected to flow overland from a local topographic high in the southeast portion of the PDA towards the northwest. Surface water then flows into Sams Brook and Lebreau Creek Brook, which discharges into the Pisiquid flood reservoir near the mouth of the St. Croix River in the Minas Basin approximately 22 km northwest of the PDA. Surface water within the PDA east of the existing quarry is expected to flow directly to the St. Croix River approximately 750 m east of the PDA. Both flow paths ultimately lead to the Minas Basin, which drains into the Bay of Fundy, approximately 45 km northwest of the PDA. Small lakes and wetland areas are located in the central and northern parts of the PDA.



Legend

- Project Development Area (PDA)
- Watershed Boundary
- Rail Road
- Arterial
- Dryweather Road
- Local Road
- Contour (5m)
- Watercourse
- Waterbody
- Wetland



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Google, Esri, USGS

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Project Location
Spence Quarry
Windsor, NS

Prepared by AC on 2025-03-03

Client/Project 121418141
Spence Aggregates Limited
Spence Quarry Expansion

Figure No.
5.2.1

Title
Local Topography

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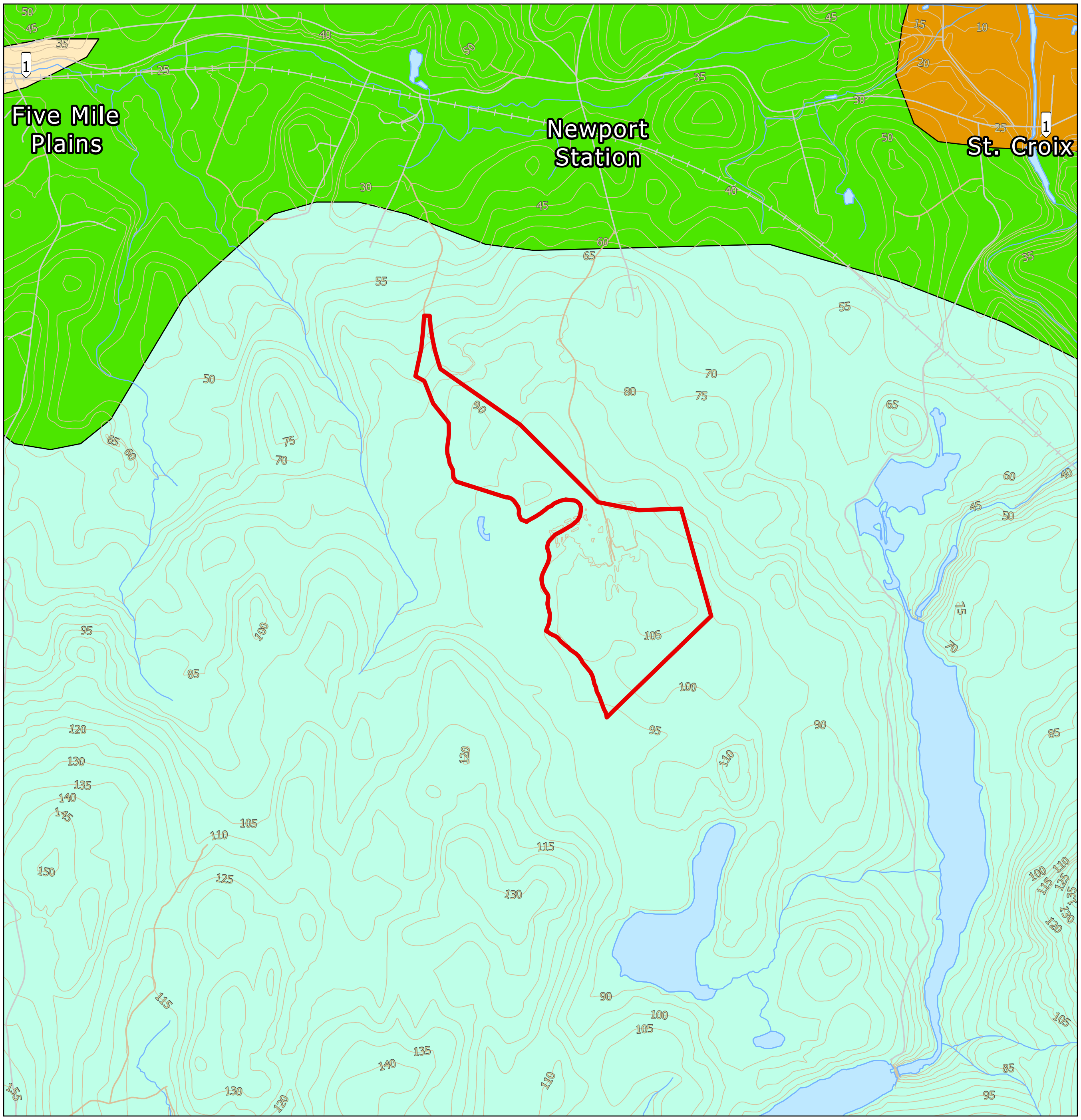
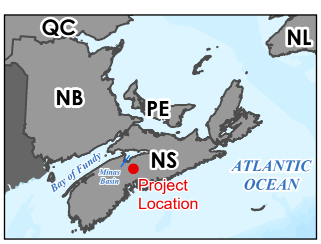
5.2.1.2.2 Surficial Geology

Available surficial geology mapping indicates that the PDA consists of a ground moraine and streamlined drift unit type, which is categorized as a stony till plain with the last glacial period (Stea et al. 1992). This till is a mixture of gravel, sand, and mud of direct glacial origin, often sandy and stony, with loose inclusions of waterlain sediment (Stea at al. 1992). The surficial geology of the PDA is shown on Figure 5.2.2.





Legend

- Project Development Area (PDA)

Surficial Geologic Units

- Alluvial Deposits
- Glaciofluvial Deposits (Kames and Eskers)
- Stony Till Plain (Ground Moraine)
- Silty Till Plain (Ground Moraine)

- Rail Road
- Arterial
- Resource Road
- Local Road
- Contour (5m)
- Watercourse
- Waterbody

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Project Location
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Spence Quarry Expansion

Figure No.
5.2.2

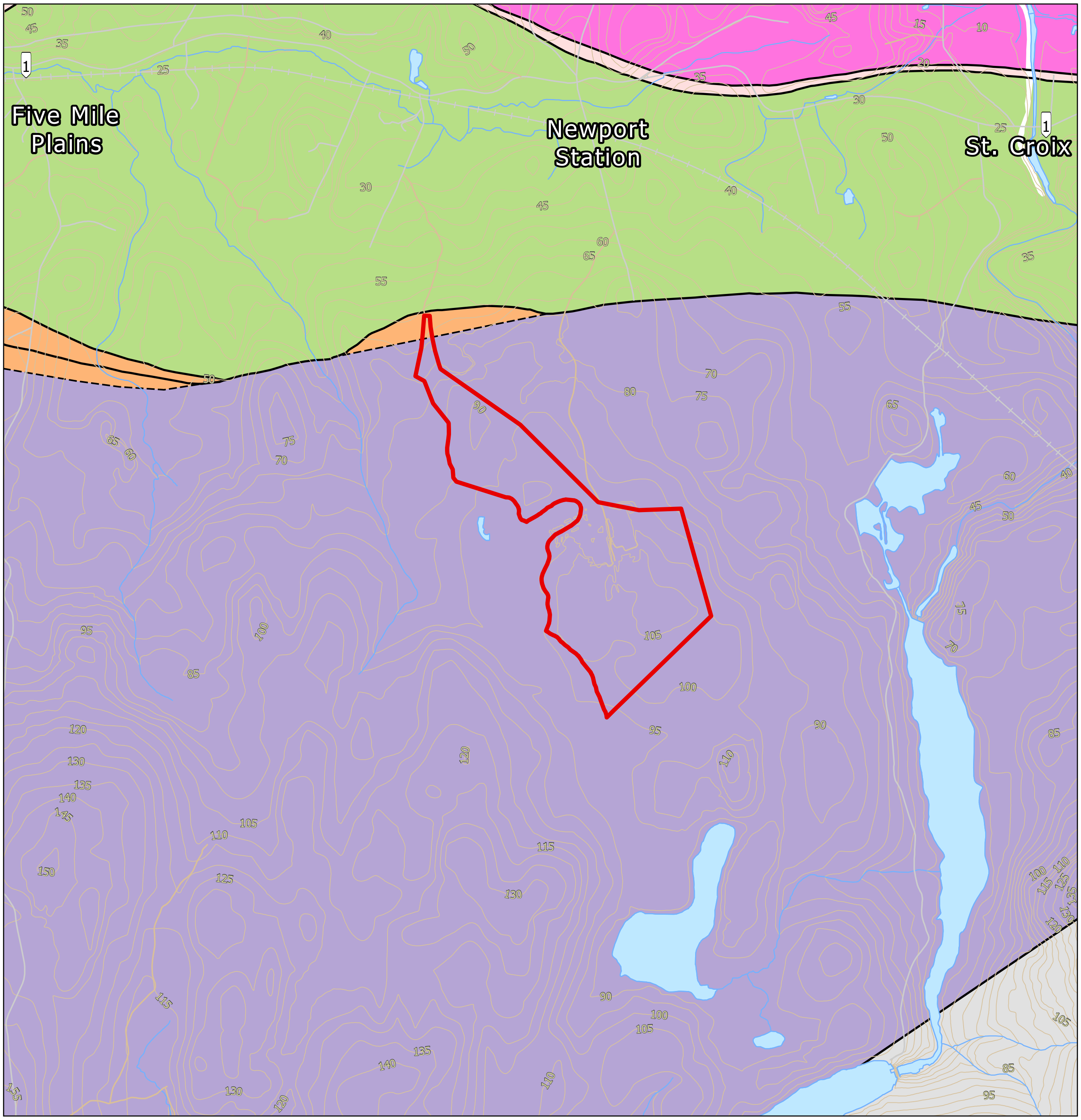
Title
Surficial Geology

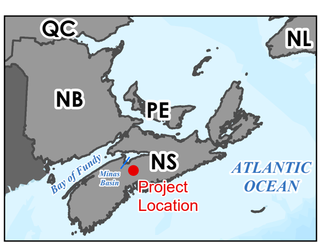
Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: NSDNR, GeoNOVA, NRCAN, (Stea et al., 1992)
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri, USGS

5.2.1.2.3 Bedrock Geology

Beneath the overburden, the bedrock primarily consists of massive, grey to greenish grey quartzose sandstones, generally poorly sorted with a chlorite-rich matrix, interbedded with subordinate grey to black slate of the Cambro-Ordovician Goldenville Formation of the Meguma Group (Keppie 2000). The rocks have undergone regional metamorphism to greenschist facies, with local occurrences of amphibolite facies.

The bedrock in the northern part of the PDA consists of sedimentary rock from the Cheverie and Horton Bluff Formations of the Horton Group, dated to the Late Devonian to Early Carboniferous (Moore et al. 2009). The sediments were deposited in fluvial and lacustrine intermontane environments and comprise non-marine clastic rocks, typically red, grey, and black. The rocks are predominantly arkosic to subarkosic, with occasional lithic and orthoquartzitic units. The Horton Group unconformably overlies the older basement rocks of the Meguma Group (Keppie 2000). Faulting is common in the vicinity of the site (Moore et al. 2009). The bedrock geology is shown on Figure 5.2.3.





Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: NSDNR, GeoNOVA, NRCAN, (Keppie, 2000), (Moore et al. 2009)
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri, USGS

Legend

Project Development Area (PDA)

Bedrock Geology

Horton Group
- Cheverie Formation
- Horton Bluff Formation

Meguma Group
- Goldenville Formation
- Halifax Formation

Windsor Group
- Macumber Formation
- White Quarry Formation

Geological Contact (assumed)
Fault (assumed)

Rail Road
Arterial
Resource Road
Local Road
Contour (5m)
Watercourse
Waterbody

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Project Location
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Windsor, NS

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Spence Quarry Expansion

Figure No.
5.2.3

Title
Bedrock Geology

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5.2.1.2.4 Groundwater Quantity

Groundwater within the PDA originates from recharge from precipitation and snowmelt through the overburden and fractured bedrock in the vicinity of the PDA. On a regional scale, groundwater flow direction would be expected to follow topography, with flow towards the Minas Basin and Bay of Fundy northwest of the PDA.

In the absence of site-specific data, the direction of local groundwater flow in the surficial aquifer (i.e., groundwater in overburden) within the PDA is assumed to generally follow local topography. Based on topographic (Figure 5.2.1) and watershed maps, the PDA is inferred to straddle a groundwater divide, with local groundwater flow in the western portion flowing northwest, and flow in the eastern portion directed northeast. It is expected that the groundwater system in the area will be largely controlled by surface runoff and local recharge. Shallow groundwater in overburden in both east and west portions of the PDA are expected to ultimately discharge into the Minas Basin.

Bedrock units generally have very low matrix (primary) porosity and permeability values. Groundwater storage and flow within the bedrock aquifers can therefore be expected to mainly occur within secondary openings, such as fractures and joints, and vary depending on the frequency and interconnection of these structural features. Groundwater recharge and flow directions in the northern portion of the PDA may be locally influenced by the unconformable contact between the Meguma and the Horton Groups, which generally trends east-west (Figure 5.2.3).

The southern portion of the PDA is within Nova Scotia's metamorphic groundwater region, while the northern part is within the sedimentary groundwater region (Kennedy and Drage 2008). Based on data from 18,878 drilled wells, the metamorphic groundwater region is characterized by a median drilled well yield of 13.6 litres per minute (L/min) (Kennedy and Drage 2008). Constant rate pumping test data from 191 wells in this region (Kennedy and Drage 2009) showed a higher median yield of 20.0 L/min and specific capacity of 2.1 cubic metres per day per metre (m^3/d/m).

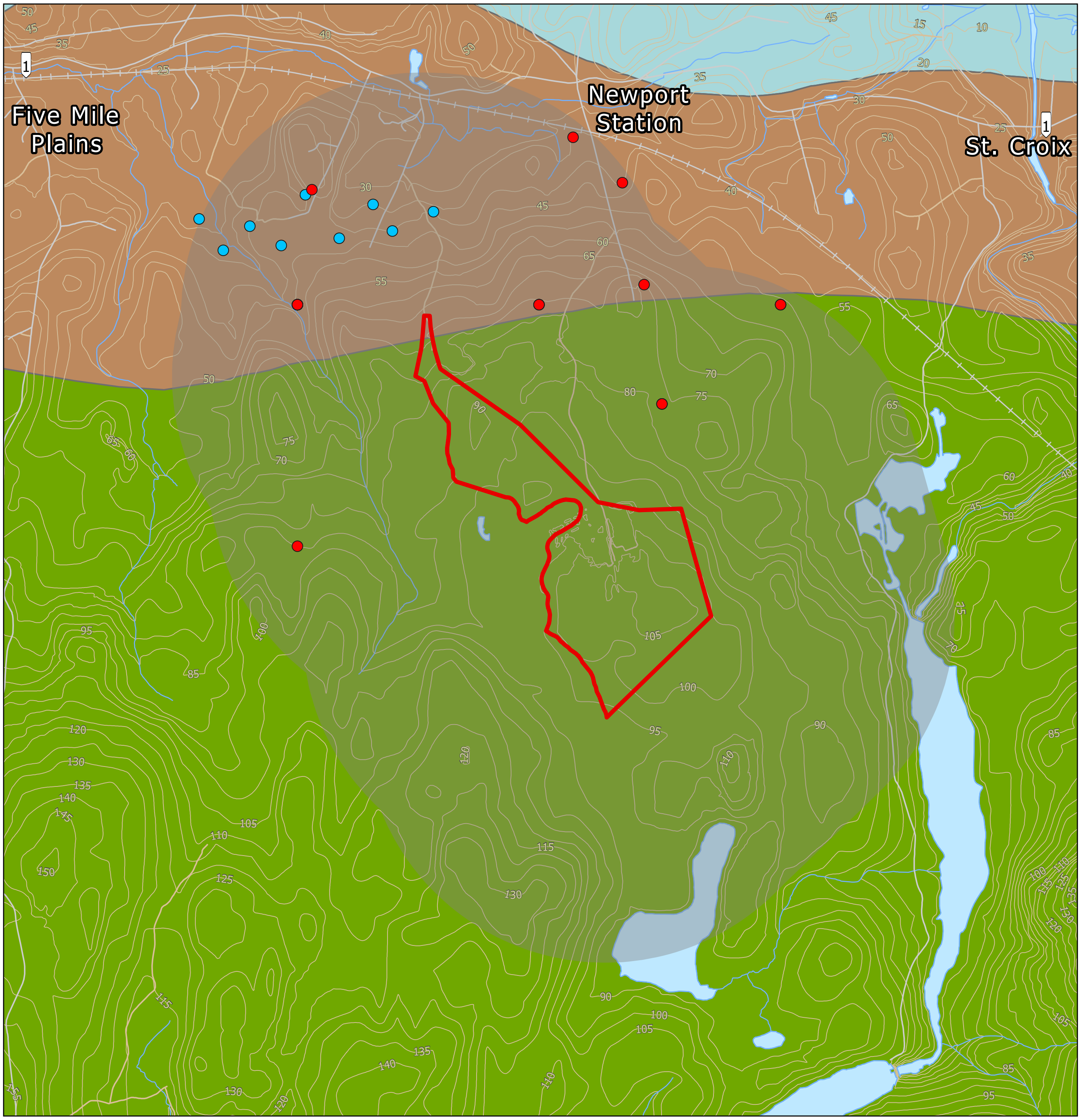
Wells located in the sedimentary groundwater regions typically have higher yield than those in metamorphic groundwater region. Based on data from 35,279 drilled wells, the sedimentary groundwater region is characterized by a median drilled well yield of 36.3 L/min (Kennedy and Drage 2009). Constant rate pumping test data from 387 wells in this region (Kennedy and Drage 2009) showed a higher median yield of 181.8 L/min and specific capacity of 20.4 m^3/d/m.

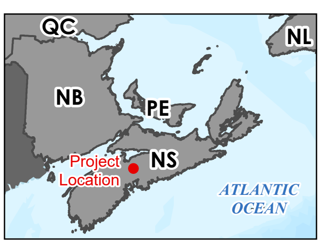
Water wells within 1,000 m of the PDA were identified and reviewed using the georeferenced version of the Nova Scotia Well Log Database (NSWLD) (Kennedy and Fisher 2018). Information reviewed including location, construction details, yield, and water use. Table 5.2.1 presents a summary of the available well record information from the NSWLD for nine drilled wells identified within 1,000 m of the PDA. The locations of these wells are shown on Figure 5.2.4.

Table 5.2.1 Summary of Domestic Water Well Records within 1,000 m of PDA

Location	Depth (m)	Casing Length (m)	Depth to Bedrock (m)	Yield (L/min)	Static Water Level (m)	Drill Date	Bedrock Groundwater Region
St. Croix	45.07	9.74	8.53	90.8	9.14	7/6/1984	Metamorphic
Newport Station	15.53	6.39	4.57	90.8	5.48	9/7/1992	Metamorphic
Newport Station	41.11	30.45	28.32	36.32	-	12/14/1994	Sedimentary
St. Croix	48.72	12.18	5.18	31.78	0.91	7/8/1998	Sedimentary
Newport Station	44.15	24.06	22.84	68.1	16.75	6/8/1999	Sedimentary
Newport Station	87.39	19.18	17.36	18.16	12.18	10/23/2001	Sedimentary
Newport Station	48.72	12.18	9.44	15.89	-	9/2/2004	Metamorphic
Newport Station	48.72	18.27	5.48	227	-	6/29/2005	Sedimentary
Five Mile Plains	79.17	24.36	15.22	15.89	-	11/16/2007	Sedimentary

Notes:
“-“ – data not available
Source: Kennedy and Fisher 2018





Legend

- Project Development Area (PDA)
- Project Development Area buffer (1km)
- Domestic Well
- Exploration Well

Bedrock Groundwater Regions

- Carbonate/Evaporite
- Metamorphic
- Sedimentary
- Rail Road
- Arterial
- Resource Road
- Local Road
- Contour (5m)
- Watercourse
- Waterbody

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Project Location
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Windsor, NS

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Figure No.
5.2.4

Title
Well Records within 1000m of the PDA

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: NSDNR, GeoNOVA, NRCAN
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri, USGS

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Six of the nine wells were reportedly drilled in the sedimentary bedrock of the Horton Group with well yields ranging from 16 L/min to 227 L/min. Three of the nine wells surrounding the PDA were reportedly drilled in the metamorphic bedrock of the Meguma Group with well yields ranging from 16 L/min to 91 L/min.

Well depths vary based on the mapped bedrock type. Wells mapped in the sedimentary bedrock reported well depths ranging from 41.11 m to 87.39 m. Wells mapped in the metamorphic bedrock reported well depths ranging from 15.53 m to 48.72 m.

In the available well records, depth to bedrock (i.e., overburden thickness) in the nine wells range from as shallow as 5.18 m to as deep as 28.32 m. Depth to static water level in the nine wells range from 0.91 m to 16.75 m.

In addition to domestic water wells, there are nine exploration wells within 1,000 m of the PDA with available well record information from Saarberg Interplan Canada for uranium exploitation (AR ME 1980). Table 5.2.2 presents a summary of the available well record information for nine exploration wells identified within 1,000 m of the PDA (AR ME 1980). The locations of these wells are shown on Figure 5.2.4.

Current quarry operations reportedly operate above the water table, with water levels noted below the quarry floor in a sump.

Table 5.2.2 Summary of Exploration Well Records within 1,000 m of PDA

Exploration Well ID	Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	Drill Date
1/46	57.9	4.6	-	1979
1/47	51.8	6.0	2.2	1979
1/48	79.9	13.1	-	1979
1/49	61.6	6.0	-	1979
1/50	58.5	3.0	4.1	1979
1/51	49.4	4.6	-	1979
1/52	39.6	3.0	3.5	1979
1/53	31.4	4.0	-	1979
1/54	39.6	2.6	-	1979

Notes:
"-" – data not available
Source: AR ME 1980

5.2.1.2.5 Groundwater Quality

Groundwater quality data are not available for groundwater within 1,000 m of the PDA from the publicly available NS Groundwater Chemistry Database. However, median water quality data (general chemistry parameters and metals) are available for the metamorphic and sedimentary groundwater regions (Kennedy and Drage 2009). Table 5.2.3 presents the median values for general chemistry parameters. Table 5.2.4 presents the median and geometric mean for arsenic, iron, manganese, and uranium. General chemistry and metals results were compared to the GCDWQ (Health Canada 2025) and CWQG-FAL.

Groundwater quality within surficial groundwater regions typically exhibits low alkalinity and hardness, along with moderate total dissolved solids (TDS). Wells in the sedimentary groundwater regions generally report moderate to high TDS and hardness compared to wells in metamorphic groundwater regions. Naturally occurring trace metals, including arsenic, iron, manganese, and uranium, as well as occasional fluoride are observed across all groundwater regions but are mostly associated with metamorphic groundwater regions (Kennedy and Drage 2009).

Table 5.2.3 Median Values of Select General Chemistry Parameters for Groundwater Regions

Parameter	Units	Guidelines	Groundwater Region		
			Surficial (All)	Sedimentary	Metamorphic
Alkalinity	mg/L	-	30.0	100.0	56.0
Hardness	mg/L	-	68.7	113.0	63.7
TDS	mg/L	500[A]	131.8	200.5	146.0
Calcium	mg/L	-	20.0	34.7	19.8
Magnesium	mg/L	-	3.1	4.3	3.1
Potassium	mg/L	-	1.5	1.6	1.3
Sodium	mg/L	200[A]	13.8	20.0	21.3
pH	pH units	7.0 – 10.5[A] / 6.5 – 9.0[D]	7.0	7.8	7.3
Chloride	mg/L	250[A] / 640[C] / 120[D]	22.8	25.7	21.0
Fluoride	mg/L	1.5[B] / 0.12[D]	0.05	0.10	0.16
Nitrate/Nitrite	mg/L	-	0.32	0.17	0.03
Sulphate	mg/L	500[A]	11.0	13.0	11.0

Notes:
Bold – Value exceeds the GCDWQ aesthetic objective
Underlined – Value exceeds the GCDWQ maximum acceptable concentration
Italicized – Value exceeds the CWQG-FAL Short Term guideline
Shaded – Value exceeds the CWQG-FAL Long Term guideline
"-" – No guideline available
[A] – GCDWQ aesthetic objective
[B] – GCDWQ maximum acceptable concentration
[C] – CWQG-FAL Short Term guideline
[D] – CWQG-FAL Long Term guideline
Source: Kennedy and Drage 2009

Table 5.2.4 Median and Geometric Mean Values of Select Metals for Groundwater Regions

Parameter	Units	Guidelines	Surficial (All)		Sedimentary		Metamorphic	
			Median	Geomean	Median	Geomean	Median	Geomean
Arsenic	µg/L	10^B / 5^D	1.0	1.2	1.0	1.6	1.0	1.9
Iron	µg/L	100^A / 300^D	50.0	88.2	30.0	57.5	91.0	**143.2**
Manganese	µg/L	20^A / 120^B / Equation^E	15.0	18.0	7.0	13.2	**43.0**	**37.4**
Uranium	µg/L	20^B / 33^C / 15^D	0.1	0.2	0.6	0.6	0.2	0.3

Notes:
Bold – Value exceeds the GCDWQ aesthetic objective
Underlined – Value exceeds the GCDWQ maximum acceptable concentration
Italicized – Value exceeds the CWQG-FAL Short Term guideline
Shaded – Value exceeds the CWQG-FAL Long Term guideline
"-" – No guideline available
A – GCDWQ aesthetic objective
B – GCDWQ maximum acceptable concentration
C – CWQG-FAL Short Term guideline
D – CWQG-FAL Long Term guideline
E – The CWQG-FAL guideline is expressed as dissolved manganese using the calculator in Appendix B of the Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese (CCME 2019). The calculator is based on pH and hardness. The GWQG-FAL guidelines for the groundwater regions were calculated using the median values of pH, hardness, and manganese. The CWQG-FAL guideline for Surficial (All) is 500 µg/L; the CWQG-FAL for Sedimentary is 370 µg/L; and the CWQG-FAL for Metamorphic is 430 µg/L.
Source: Kennedy and Drage 2009

Groundwater quality data from Kennedy and Drage (2009) were compared to GCDWQ and CWQG-FAL guidelines. The metamorphic groundwater region reported exceedances of fluoride, iron (geometric mean), and manganese (median and geometric mean). The median fluoride value (0.16 mg/L) exceeded the CWQG-FAL Short Term guideline of 0.12 mg/L. The geometric mean iron value (143.2 µg/L) exceeded the GCDWQ AO guideline of 100 µg/L. The median (43.0 µg/L) and geometric mean (37.4 µg/L) manganese values exceeded the GCDWQ AO guideline of 20 µg/L. The surficial and sedimentary groundwater regions did not reported exceedances of GCDWQ or CWQG-FAL guidelines.

5.2.1.2.6 Acid Rock Drainage

Acid rock drainage (ARD) is the result of exposure of sulphide-rich rocks to oxidizing environments, including precipitation. Earthwork activities around these sulphide-rich rocks can increase the rock exposure and thus the acid-generating potential. Not all sulphide-containing rocks produce ARD. In many cases, rocks contain enough carbonate minerals to buffer the sulphide effect. In these instances, ARD is not produced. Acid producing potential is considered an important and regulated constraint for development. The current assessment of bedrock geology is based on a desktop review of available provincial mapping and ARD studies.

As shown on Figure 5.2.3, bedrock underlying the PDA primarily consists of the Goldenville Formation and the Horton Bluff Formation at the most northern portion of the PDA. Studies of acid-generating potential (White and Goodwin 2011) indicate that the Goldenville Formation contains both potentially acid-generating and non-acid generating bedrock units. Therefore, the Goldenville Formation is considered to have a moderate potential for ARD. The Horton Bluff Formation contains acid buffering minerals (i.e., carbonate-rich minerals), such as limestone and dolostone (Moore et al. 2000). Therefore, the Horton Bluff Formation is considered to have a low potential for ARD. If sulphide-rich rock is encountered during development, it will be managed and disposed of according to Nova Scotia's *Sulphide Bearing Material Disposal Regulations* (NSDECC 2021).

5.2.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for groundwater resources is provided in Table 5.2.5. Potential environmental effects and measurable parameters were identified based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.2.5 Potential Effects, Effect Pathways and Measurable Parameters for Groundwater Resources

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in groundwater quantity	• Changes in groundwater flow and recharge rates in quarried areas where exposed areas of overburden removal associated with earthworks activities exposed bedrock has more impervious surfaces that can result in increased runoff and decreased recharge to the aquifer, thereby changing groundwater flow conditions. • Change in groundwater levels due to blasting and dewatering activities • Change in groundwater yield for existing well users in proximity to the PDA due to potential damages resulting from blast vibrations	• Groundwater levels
Change in groundwater quality	• Changes in groundwater chemistry from infiltrating water in exposed areas of overburden removal associated with earthworks activities • Changes in groundwater chemistry from infiltrating water in areas where blasting occurs • Contamination of groundwater from temporary increases in turbidity near potable wells as a result of blasting vibrations • Contamination of groundwater from water quality changes related to the acid rock drainage potential in some bedrock formations • Degradation of groundwater quality in potable water supplies compared to applicable guidelines	• Water quality, including analysis of general chemistry parameters and metals

The Project will interact with groundwater resources resulting in a change in groundwater quantity and/or quality as a result of the following activities:

- Site preparation, including clearing and grubbing to facilitate expansion of the quarry footprint and installation of site management features (e.g., erosion and sediment controls)
- Access road upgrades and realignment, including road widening and replacement/upgrades of roads and culverts
- Presence and operation of Project vehicles and equipment within the PDA
- Aggregate extraction (i.e., drilling, blasting, and excavation), processing (i.e., crushing and screening), and stockpiling
- Progressive and final reclamation of the expanded quarry footprint

5.2.3 Mitigation and Management Measures

The following mitigation measures specific to groundwater resources have been identified for the Project:

- Groundwater quantity and quality will be monitored and adaptively managed, as required. Details of ground water monitoring will be specified in the application for amendment for the existing IA.
- The Proponent is prepared to provide temporary water supply until a permanent resolution is made, should existing supplies be disrupted by either drawdown of the water table or by damage from blasting associated with the Project.
- In the event that wells are adversely or permanently affected by construction or operation activities, the Proponent will repair or replace affected wells to conditions that existed prior to activities.
- If sulphide-rich rock is encountered during operations, it will be managed and disposed of according to Nova Scotia’s Sulphide Bearing Material Disposal Regulations (NSDECC 2021).

Design mitigation and standard best management practices will also be implemented to avoid or reduce potential effects on groundwater resources.

5.2.4 Residual Environmental Effects

A significant residual environmental effect on groundwater resources for the Project is defined as any of the following:

- Decrease in the yield from an existing and otherwise adequate groundwater supply well to the point where it is inadequate for its intended use
- Change in groundwater quality, such that the quality of groundwater from an otherwise adequate water supply well that meets applicable guidelines deteriorates to the point where it becomes non-potable or cannot meet the GCDWQ (Health Canada 2025) for a consecutive period exceeding 30 days
- Physical or chemical alteration to an aquifer to the extent that interaction with local surface water results in streamflow or surface water chemistry changes that adversely affect aquatic life or a downstream surface water supply.

Project-related residual environmental effects on groundwater quantity and quality are evaluated below.

5.2.4.1 Change in Groundwater Quantity

Local changes in infiltration rates through compaction of ground surfaces may result in reduced infiltration within the PDA. Stripping of overburden and removal of vegetation in the PDA will result in changes in evapotranspiration rates and runoff and may result in decreased infiltration rates where impervious surfaces remain, or increased infiltration rates where vegetation is removed. These changes are considered to have a limited effect on groundwater resources due to their limited extent of development (footprint) during construction.

Change in groundwater flow patterns and recharge rates may affect groundwater discharge to surface water features and wetlands. Potential effects to surface water features and wetlands from the lowering of groundwater levels and changes to baseflow are further discussed in section 5.3.

Vibration damage to a drilled or dug well is a potential effect of rock blasting during the operation phase. The likelihood of this effect is generally a function of the distance between the energy source and the receptor well, and the seismic properties of the intervening subsurface materials. With respect to rock type, the risk of water well damage is greater for fractured crystalline bedrock than for overburden wells or soft bedrock (e.g., gypsum, sandstone, shale). Based on experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 m to 200 m, and minimal beyond approximately 200 m. Vibration damage is considered to have a limited effect on groundwater quantity since domestic and exploration wells in the area are beyond 200 m of the PDA.

The existing quarry depth ranged from 15 m to 20 m below the ground surface and is located on a ridge. This ridge may act as a recharge zone, with groundwater flowing toward lower elevation on either side, predominantly from southeast to northwest, with some discharge to local wetlands expected. Groundwater levels in the PDA were evaluated using data from domestic and exploration wells located within 1,000 m of the PDA, as no well data is publicly available within the PDA. The data indicate that the groundwater levels within the PDA are shallow, particularly in the areas off the ridge and ranged from 0.91 m to 16.75 m. Based on the available data and experience with the existing quarry, the expansion will likely be working under the water table as the quarry expands away from the topographic high and will require dewatering. The planned quarry expansion to the northwest is in an area of low topography compared to the existing quarry in the southeast portion of the PDA. The likelihood of encountering shallow groundwater increases in the northwest portion of the PDA due to the decline in topography. Water level monitoring will be conducted on a regular basis to determine groundwater elevations as the quarry footprint increases in size.

During decommissioning and reclamation, the Project activities and components that may interact with groundwater quantity and result in an environmental effect include rising groundwater levels immediately upon cessation of dewatering the quarry.

During progressive and closure rehabilitation, the removal and/or rehabilitation of the aggregate stockpiles can change groundwater recharge rates (e.g., through re-vegetation). These changes will affect groundwater flow patterns and discharge to surface water features and wetlands. Groundwater inflow, combined with the surface water runoff, will allow the open pit(s) to fill to the static groundwater levels (i.e., water table) at the site, if encountered. Potential effects to surface water features and wetlands are further discussed in section 5.3.

5.2.4.2 Change in Groundwater Quality

Site preparation and groundworks could result in changes in groundwater chemistry from infiltrating water in exposed areas of overburden removal, and ammonia and/or silt contamination from blasting.

Earthwork activities will increase the bedrock exposure, which can increase the potential for ARD. Bedrock underlying the PDA generally has a moderate potential for ARD (section 5.2.1.2.6). Bedrock underlying the most northern portion of the PDA (i.e., the Horton Bluff Formation) has a low potential for ARD. The Nova Scotia *Sulphide Bearing Material Disposal Regulations* (NSECC 2021) indicate that a sulphide-bearing material is an aggregate that has a sulphide sulphur content equal to or greater than 0.4% (or 12.51 kg H_2SO_4/tonne). If sulphide-rich rock is encountered during development, it will be managed and disposed of according to Nova Scotia's *Sulphide Bearing Material Disposal Regulations* (NSDECC 2021).

An analysis of existing conditions of the PDA (section 0) indicates that groundwater generally has a low alkalinity, low hardness, and a moderate TDS. Natural exceedances were reported for fluoride, iron, and manganese in the metamorphic groundwater regions. Where necessary, effluent from blasted areas will be monitored, sampled and compared to baseline conditions. If required, effluent will be treated prior to discharge.

There is potential for Project-related environmental effects to groundwater quality because of Project components and activities. Groundwater quality effects may include contamination of groundwater from accidental spills of fuel, lubricants, or blasting chemicals, or temporary increases in turbidity in nearby potable wells because of blasting vibrations. Project-related contamination (e.g., accidental petroleum hydrocarbon spills from machinery or blasting chemicals) could theoretically affect the groundwater at the mine and potentially affect well water quality downgradient of the Project.

Siltation of water in domestic wells nearby the PDA is a potential effect of the vibrations from rock blasting activities. The effect is temporary in nature and primarily the result of resuspension of silt at the bottom of a well or from borehole walls. In aquifers with large fracture systems, silt may be directly sourced from silt and sediment produced from the blasting. The potential for these wells to be affected by blasting vibrations is related to the separation distance, blast magnitude, the physical properties of the bedrock being excavated, and the actual well construction and age. Nine wells with publicly available data are within 1,000 m of the PDA. Siltation from blasting, however, is considered to have a limited effect on groundwater quality since available domestic and exploration wells in the area are not within 200 m of the PDA.

During operation, rock blasting activities can increase the potential of ARD from exposure of sulphide-rich bedrock. This can result in decreased pH of associated waters, which can then result in mobilization of metals and adversely affect aquatic habitats. Bedrock underlying the most northern portion of the PDA (i.e., the Horton Bluff Formation) has a low potential for ARD, while the southern portion of the site has a moderate potential for ARD (i.e., the Goldenville Formation). The Nova Scotia *Sulphide Bearing Material Disposal Regulations* (NSDECC 2021) indicate that a sulphide-bearing material is an aggregate that has a sulphide sulphur content equal to or greater than 0.4% (or 12.51 kg H_2SO_4/tonne). Groundwater quality effects from ARD may be observed through decreased pH and increased metal parameters. If sulphide-rich rock is encountered during development, it will be managed and disposed of according to Nova Scotia's *Sulphide Bearing Material Disposal Regulations* (NSDECC 2021).

Water quality monitoring will be conducted on a regular basis to document the effects of changes in groundwater chemistry associated with the Project.

The main potential effect to groundwater quality during reclamation is the drilling and blasting activities to rehabilitate the quarry. Blasting of the existing quarry faces during this phase can increase the potential of ARD from exposure of sulphide-rich bedrock. This can result in the acidification of associated waters and lead to the mobilization of metals.

Further analysis may be required to determine the ARD potential of the bedrock underlying the PDA. Siltation is considered to have a limited effect on groundwater quality since domestic and exploration wells in the area are not within 200 m of the PDA. Potential effects to surface water features and wetlands are further discussed in section 5.3.

During post-closure monitoring, interaction with groundwater quality will be limited to monitoring of groundwater chemistry.

5.2.4.3 Summary

Based on application of the mitigation measures identified in section 5.2.3 and the Proponent's commitment to comply with regulatory standards, residual environmental effects on groundwater resources are likely to not be significant.

5.2.5 Follow-up and Monitoring Programs

Follow-up and monitoring programs are intended to verify the accuracy of predictions made during the EA, to assess the implementation and effectiveness of mitigation and the nature of the residual effects, and to manage adaptively, if required.

During Project development, a groundwater monitoring program will be implemented to confirm potential changes in groundwater associated with Project activities. The groundwater monitoring program will be developed based on regulatory requirements for both water level and quality and will document groundwater resources and recovery in groundwater levels across the PDA. Details related to groundwater monitoring will be specified in the application for amendment for the existing IA.

5.3 Aquatic Environment

The assessment of potential environmental effects of the Project on the aquatic environment is provided in this section. For the purposes of the assessment, the Aquatic Environment VC includes surface water resources and fish and fish habitat.

The aquatic environment has been assessed as a VC because it provides economic, cultural, recreational, and ecological value to the public, Indigenous groups, businesses, and government agencies. Clean and abundant water is essential for people, the environment, and local ecosystems. Fish which live in these ecosystems are valued by resource users for fishing activities and as a source of food, so it is important to maintain stable populations within the region.

The Aquatic Environment VC includes fish and fish habitat, as defined under the federal *Fisheries Act* and includes:

- Fish, which include: (i) parts of fish; (ii) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals; and (iii) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans, and marine animals
- Fish habitat, which includes waters frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply, and migration areas

Watercourses and waterbodies near the Project provide habitat and food for aquatic ecosystems which include fish, benthic communities and aquatic plants, and provide food for other organisms (i.e., birds and mammals). The aquatic environment can be affected by Project-related changes to groundwater resources (section 5.2) and vegetation and wetlands (section 5.4) through localized changes in surface water runoff which may result in changes to surface water quality or fish habitat (e.g., sediment transport).

In addition to Nova Scotia's Environmental Assessment Regulations, the Project is subject to other federal and provincial legislation, policies, and guidance. This section identifies the primary regulatory requirements and policies which influence the management and protection of fish and fish habitat in Canada and Nova Scotia.

The federal *Fisheries Act* is administered primarily by the Department of Fisheries and Oceans Canada (DFO) with some provisions administered by ECCC. The *Fisheries Act* protects fish and fish habitat and addresses national interests in marine and fresh waters with the goal of protecting the long-term sustainability of aquatic resources. The *Fisheries Act* includes prohibitions against works, undertakings or activities that result in the HADD of fish habitat (section 35(1)) without authorization from DFO. HADD of fish habitat is defined under the *Fisheries Act* policies as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish." The *Fisheries Act* also prohibits the carrying out of a work, undertaking, or activity, other than fishing, that results in the death of fish (section 34.4(1)).

In both cases, works can be approved by and carried on in accordance with conditions established by the Minister of Fisheries. Any such work requires an authorization (section 35(2)(b) and section 34.4(2)(b)) and an appropriate offsetting (e.g., habitat compensation).

Section 34.3(2) provides provisions for maintaining adequate flow and respecting the free passage of fish.

Under section 36 of the *Fisheries Act*, "no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish" without authorization.

The federal *Species at Risk Act* (SARA) provides protection for SAR in Canada. The legislation provides a framework to facilitate recovery of species listed as Threatened, Endangered, or Extirpated, and to prevent species listed as Special Concern from becoming Threatened or Endangered. Endangered or Threatened SAR on Schedule 1 and their habitats are protected under SARA, which prohibits: 1) the killing, harming, or harassing of Endangered or Threatened SAR (sections 32 and 36), and 2) the destruction of critical habitat of an Endangered or Threatened SAR (sections 58, 60, and 61). Species listed as Special Concern on Schedule 1 of SARA, species listed on Schedule 2 and 3, and species with no SARA status are not subject to these prohibitions.

From a provincial perspective, key legislation related to the protection of the aquatic environment includes the *Environment Act* and the *Endangered Species Act*. The *Environment Act*, administered by NSECC support the preservation, management, and sustainable use of environmental resources in Nova Scotia. Within the *Environment Act* there are several regulations and orders to protect the aquatic environment, including the Environmental Assessment Regulations, Activities Designation Regulations, regulations designating protected water areas, and the Watercourse Alteration Standard Order.

The Nova Scotia *Endangered Species Act* (NS ESA) provides protection, designation, recovery, and conservation for SAR and their habitats to prevent extirpation or extinction because of human activity. The NS ESA defines species as a plant, animal, or other organism, and includes one or more populations of a species, and the eggs, larvae or other forms of developmental life of a species and any part of an individual of a species but does not include a domesticated species.

5.3.1 Existing Conditions

A characterization of the existing conditions for the aquatic environment within the spatial boundaries of the PDA includes a discussion of the influences of past and present physical activities on the VC, leading to the current conditions.

The PDA is located within the Avon River Watershed and the St. Croix Watershed. Water from the west of the PDA drains into Sams Brook, which flows into Lebreau Creek Brook, Lebreau Creek, Avon River and Minas Basin in the Bay of Fundy. Water from the east of the PDA drains east through vegetated cover to the St. Croix River and into the Minas Basin in the Bay of Fundy. To reduce effects to environmental receptors, the PDA has been refined to largely avoid watercourses and waterbodies.

5.3.1.1 Approach and Methods

Existing conditions in the Aquatic Environment have been determined through both desktop methods and field programs. The methods used to acquire information on existing conditions relative to the Aquatic Environment VC are presented in the following subsections.

5.3.1.1.1 Existing Information Sources

The review of existing literature and information included:

- Publicly available scientific information (e.g., Canadian Science Advisory Secretariat reports, COSEWIC reports or species at risk mapping)
- Publicly available hydrometric information (Water Survey of Canada)
- Publicly available satellite imagery
- Publicly available geospatial information (i.e., GIS layers and LiDAR)
- Recreational fisheries information (i.e., angler's guide)
- Data from the AC CDC

5.3.1.1.2 Field Studies

Habitat characterization was conducted in two watercourses (S01 and S02) and two ponds (P01 and P02) within or adjacent to the PDA in 2024 (Figure 5.3.1). S01 is Sam's Brook and S02 is an unmapped tributary identified from ground truthing. One of the ponds (P2) is located within the PDA and the other pond (P1) and two streams (S01 and S02) are located to the southwest of the PDA. Fish habitat information was recorded including habitat type (i.e., riffle, run, pool), substrate type, riparian vegetation as well as other habitat characteristics (i.e., cover, bank stability, channel and wetted widths).

In situ water quality data were collected from watercourses and ponds in September 2024. Water quality was sampled at one location on S1, two locations on S2, one location on P1 and one location on P2. Data collected included measurements of pH, dissolved oxygen, temperature, and conductivity. In addition to *in situ* water quality, water quality grab samples were collected at three locations (one location on S02 [SW-03], and two locations on S03 [SW-01 and SW-02] to determine baseline water quality conditions (Figure 5.3.1). Water quality data was compared to the freshwater guidelines in the CWQG-FAL (CCME 1999) to provide context for its quality in relation to freshwater aquatic ecosystems.

To assess fish communities, a variety of fishing methods were used, including backpack electrofishing in watercourses and minnow traps in ponds. Fishing effort and location were recorded. Captured fish were identified to species, measured, weighed and released alive.

Project Development Area (PDA)
Fishing Effort
Potential Unmapped Watercourse / Overland Drainage
No Visible Channel
Visible Channel
Local Road
Resource Road / Trail
Transmission Line
Watercourse
Waterbody

0 200 400 Metres
(At original document size of 8.5x11)
1:12,000

N

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by MB on 2025-01-09

Client/Project
121418141_010
Spence Aggregates Limited
Spence Quarry
Expansion

Figure No.
5.3.1

Title
Watercourses and Waterbodies near the PDA

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Google

\\ca0213-ppfss01\work_group\1214\active\1XXX - Other PCs\1214_NB\121418033\gis\mapping\aprx\121418141_Spence_Quarry_Expansion\121418141_Spence_Quarry_Expansion.aprx   Revised: 2025-04-09 By: schubbs

5.3.1.1.3 Desktop Analysis

Local Watershed and Prorated Flow

The contribution of the watershed area was used to calculate the river flow for the two sub-watersheds which drain the PDA: Avon River and St Croix River. Sub-watershed areas of 4.79 km² and 2.02 km² were delineated for Avon River and St Croix River, respectively, to two downstream drainage points from the PDA using the ArcGIS Hydro Watershed Delineation Tools and publicly available digital elevation model (NRCan 2025).

Water Balance

A water balance was developed based on available data for climate normal conditions to determine the annual runoff volume that flows from the PDA. Runoff volume was calculated in the water balance model based on climate and physiographic characteristics. The Thornthwaite monthly water balance model version 1.1.0, refined by the United States Geological Survey (USGS), was used (McCabe and Markstrom 2007; Thornthwaite 1948). Surface runoff was estimated based on net precipitation less the evapotranspiration and infiltration losses. Input parameters were established based on latitude, local climate and soil conditions, and guidance provided by the USGS. The general water balance equation used in the model is:

$$R = P - ET \pm G - O - I$$

Where, R = runoff (m^3)

P = Precipitation (m^3)

ET = Evapotranspiration (m^3)

G = groundwater import/export, considered to be 0 on an annual basis

O = outflows, i.e., water takings from the drainage area, considered to be 0 for this Project

I = infiltration (m^3)

Local climate data was obtained using the 1991-2020 Canadian Climate Normals from the nearest ECCC Climate station: Waterville Cambridge (ECCC 2024a). The input parameters included monthly precipitation, temperature, runoff factor, soil moisture storage capacity, and rain and snowfall temperature thresholds listed in Tables 5.3.1 (Climate Normals Data) and 5.3.2 (Input Parameters). These were established based on assumptions of local climate and soil conditions and guidance provided by USGS (McCabe and Markstrom 2007). Local land use and topographic data (i.e., slopes) were used to estimate the runoff factors for each watershed (McCabe and Markstrom 2007).

Table 5.3.1 Climate Normals Data (1991-2020) for Waterville Cambridge ECCC Climate Station (ID: 8206222)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Daily Temperature (°C)	-5.0	-4.6	-0.6	5.3	11.3	16.4	20.1	19.4	15.1	9.2	4.2	-1.2	7.5
Rainfall (mm)	46.4	43.7	51.5	69.4	77.2	82.2	75.4	79.7	105.7	106.5	105.3	79.6	922.8
Snowfall (cm)	78.2	60.1	45.1	13.3	0.0	0.0	0.0	0.0	0.0	0.2	14.7	55.6	268.1
Precipitation (mm)	103.6	87.3	89.8	83.4	78.1	82.2	75.4	79.7	105.7	106.7	120.1	124.9	1,137.0

Table 5.3.2 Input Parameters for Pre-Construction Environmental Water Balance

Input Parameters (units)	Avon Sub-Watershed	St. Croix Sub-Watershed
Runoff Factor (-)	0.5	0.5
Total Water (-)	1	1
Topography Factor	0.1	0.1
Soils Factor (-)	0.2	0.2
Cover Factor (-)	0.2	0.2
Direct Runoff Factor(-)	0.23	0.21
Soil-Moisture Storage Capacity (mm)	300	300
Latitude of Location (degrees)	48	48
Rain-Temperature Threshold (degC)	0	0
Snow-Temperature Threshold (degC)	-5	-5
Maximum melt rate (-)	0.5	0.5

5.3.1.2 Description of Existing Conditions

The following sections provide a summary of the aquatic environment, collected through desktop analysis, fieldprograms, and supplemented with publicly available information, that focuses on the PDA and associated watersheds.

5.3.1.2.1 Surface Water Quantity

There are two sub-watersheds that drain the PDA: Avon River sub-watershed drains the western portion of the PDA and flows into Sams Brook, Avon River and Minas Basin in the Bay of Fundy (Figure 5.3.2). The St Croix River sub-watershed drains the eastern portion of the PDA and flows into the St. Croix River and into the Minas Basin in the Bay of Fundy. Currently, surface water from the existing quarry is allowed to pond and drain naturally, either east to the St Croix watershed or west to the Avon River watershed. No current water management infrastructure or water management plan is implemented for the site.

Discharge for the Avon River and St Croix River Watersheds is found to be highest during the spring freshet in late March to April and lowest from July to September. The water balance results are presented in Tables 5.3.3 and 5.3.4 for the Avon sub-watershed and St. Croix sub-watershed, respectively. For the Avon Sub-watershed, Table 5.3.3 shows an annual precipitation of 1,215.7 mm, with an actual evapotranspiration of 578.1 mm and excess precipitation of 639.8 mm. The excess precipitation was obtained by subtracting the actual precipitation (Actual ET) from the precipitation. Excess precipitation incorporates snow storage, overland runoff, and infiltration all of which will eventually report to surface watercourses as total streamflow. Based on the Thornthwaite model, annual overland flow is expected to be 383.8 mm for the Avon sub-watershed under baseline conditions. This corresponds to an annual runoff volume of 1,839,859 m^3/year over the entire sub-watershed area.

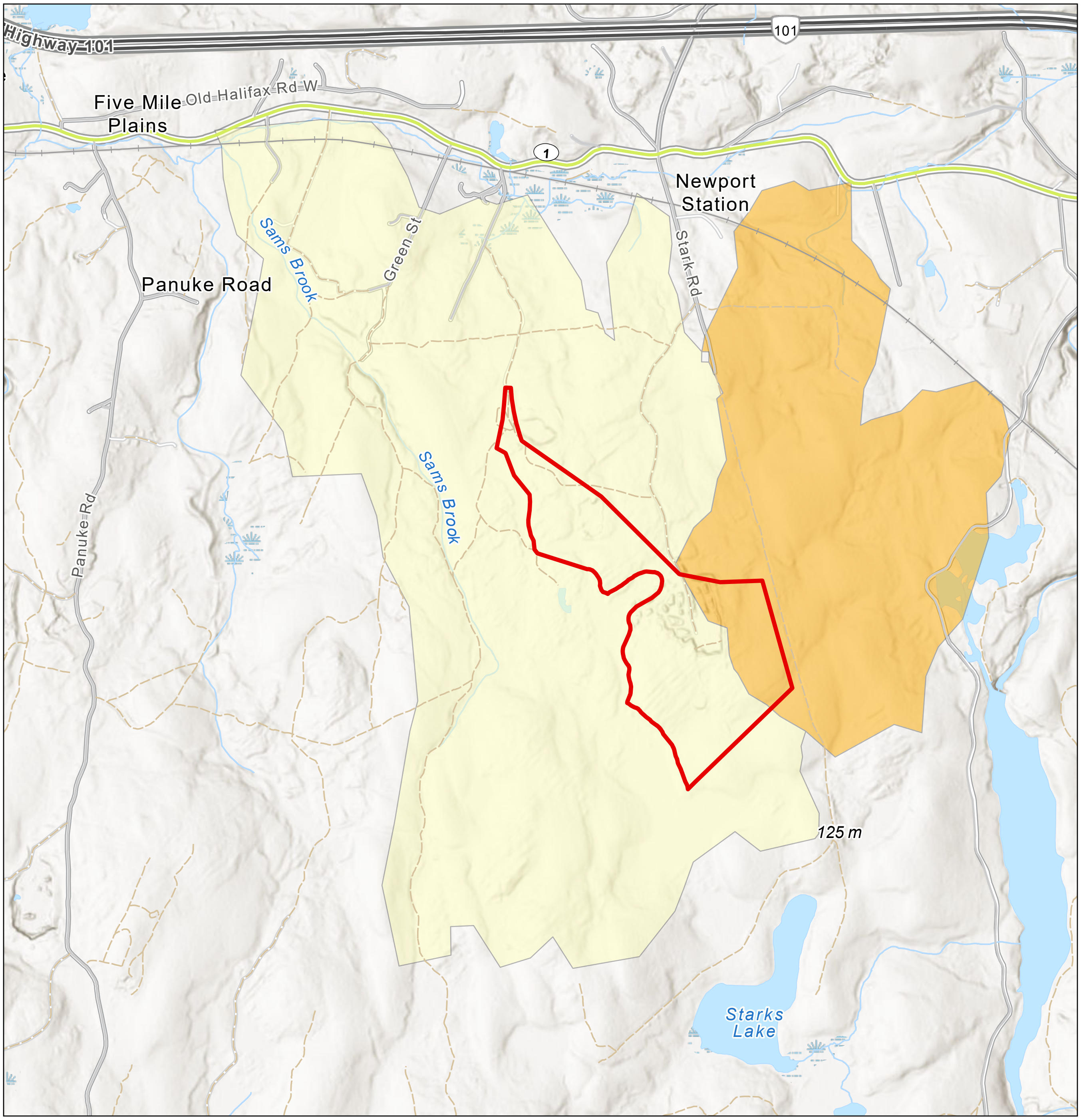
For the St. Croix Sub-watershed, Table 5.3.4 shows an annual precipitation of 1,215.7 mm, with an actual evapotranspiration of 578.1 mm and excess precipitation of 639.8 mm. The excess precipitation was obtained by subtracting the actual evapotranspiration (Actual ET) from the precipitation. Excess precipitation incorporates snow storage, overland runoff, and infiltration all of which will eventually report to surface watercourses as total streamflow. Based on the Thornthwaite model, annual overland flow is expected to be 382.9 mm for the St. Croix sub-watershed under baseline conditions. This corresponds to an annual runoff volume of 773,804 m^3/year over the entire sub-watershed area.

Table 5.3.3 Avon Sub-Watershed - Existing Conditions Environmental Water Balance for the Climate Normal Period 1991-2020

Parameters (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation	113.2	91.4	96.9	89.5	87.5	86	78.8	86	107.4	120.4	125.1	133.5	1,215.70
Actual ET	8.3	10.2	19.6	36.7	68.1	99.8	124.2	99.4	57	30	15.4	9.4	578.1
Potential ET	8.3	10.2	19.6	36.7	68.1	99.8	123.6	97.8	57	30	15.4	9.4	575.9
Excess Precipitation	104.9	81.2	77.3	52.8	19.4	-13.8	-44.8	-11.8	50.4	90.4	109.7	124.1	639.80
Total Streamflow	31.7	21.9	98.6	103.5	75	47.2	31.8	26.6	28.1	29.4	67.9	85.9	647.6
Storage Change	73.2	59.3	-21.3	-50.7	-55.6	-61.0	-76.6	-38.4	22.3	61.0	41.8	38.2	-7.8
GW Recharge	12.7	8.8	39.4	41.4	30.0	18.9	12.7	10.6	11.2	11.8	27.2	34.4	259.0
Overland flow	19.0	13.1	59.2	62.1	45.0	28.3	19.1	16.0	16.9	17.6	40.7	51.5	388.56

Table 5.3.4 St. Croix Sub-Watershed - Existing Conditions Environmental Water Balance for the Climate Normal Period 1991-2020

Parameters (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation	113.2	91.4	96.9	89.5	87.5	86	78.8	86	107.4	120.4	125.1	133.5	1,215.70
Actual ET	8.3	10.2	19.6	36.7	68.1	99.8	124.2	99.4	57	30	15.4	9.4	578.1
Potential ET	8.3	10.2	19.6	36.7	68.1	99.8	123.6	97.8	57	30	15.4	9.4	575.9
Excess Precipitation	104.9	81.2	77.3	52.8	19.4	-13.8	-44.8	-11.8	50.4	90.4	109.7	124.1	639.80
Total Streamflow	33.3	22.7	98.2	103.3	74.9	46.3	30.7	25.1	26.1	29.7	69.9	87	647.2
Storage Change	71.6	58.5	-20.9	-50.5	-55.5	-60.1	-75.5	-36.9	24.3	60.7	39.8	37.1	-7.4
GW Recharge	13.3	9.1	39.3	41.3	30.0	18.5	12.3	10.0	10.4	11.9	28.0	34.8	258.9
Overland flow	20.0	13.6	58.9	62.0	44.9	27.8	18.4	15.1	15.7	17.8	41.9	52.2	388.3



Legend

- Project Development Area (PDA)
- Highway
- Arterial
- Local Road
- Resource Road / Trail
- Railway
- Waterbody
- Watercourse

Sub-Watersheds

- Avon
- St. Croix

0 500 1,000 m

(At original document size of 8.5x11)
1:25,000

N

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by AC on 2025-04-01

Client/Project
Spence Aggregates Limited
Spence Quarry
Expansion

121418141

Figure No.
5.3.2

Title
Watersheds Underlying the PDA

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, OSM, Stantec
3. Background: Province of New Brunswick, Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NRCan, Parks Canada, Esri, NASA, NGA, USGS, Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada

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5.3.1.2.2 Surface Water Quality and Fish Habitat

The PDA has been refined to largely avoid potential effects to watercourses and waterbodies. The description of existing conditions therefore largely pertains to resources located outside of the current PDA. S1, S2 and P1 are located outside of the PDA, while P2 is located within the current PDA (Figure 5.3.1).

At the time of the survey in September 2024, the wetted width of Sam's Brook (S1) ranged from 2.34 to 3.79 m and channel width ranged from 2.45 to 4.37 m. The substrate consisted primarily of cobble (38%) and small boulder (34%). In-stream cover was provided by boulders (17%), no aquatic vegetation was present. The banks were stable, and the riparian vegetation was commonly trees (41%) or bare (32%). Habitat in Sam's Brook (S1) was considered fish habitat.

In S2, there is a 20 m section of watercourse that would be considered fish habitat. The reach dissipates into a wetland and is intermittent pools of wetland drainage for approximately 610 m upstream to where it meets an access road. No fish were observed or confirmed present in S2. S2 is considered overland drainage and does not provide habitat directly for fish.

P1 is a small, shallow 25 x 115 m waterbody which appears to be anthropogenic in origin. There is no obvious inflow or outflow, and it is not considered fish habitat. P2 is a small, shallow 25 x 45 m waterbody surrounded by floating bog which is a historic flooded quarry. There is no obvious inflow or outflow and was confirmed to not provide habitat for fish.

In situ water quality was measured in S1, S2, P1 and P2. Water temperature ranged between 13.8 and 18.1°C in early September. Specific conductivity ranged between 0.0326 and 0.0172 mS/cm. Dissolved oxygen (DO) concentrations were above the recommended CWQG-FAL of 6.5 mg/L for all life stages of coldwater fish (CCME 1999) at two sampling locations (S1 and P1), and below the CWQG-FAL for all life stages of coldwater fish at three locations (S2 at two locations and P2). The pH was within the recommended range (6.5-9.0) for CWQG--FAL at two sampling locations (S1 and P2), and below the CWQG-FAL pH at three sampling locations (S2 at two locations and P1).

Surface water quality samples were collected from three locations (SW-01, SW-02, and SW-03) on September 11, 2024 (Figure 5.3.1). Water quality samples were compared to the CWQG FAL. Surface water hardness (as calcium carbonate $CaCO_3$) was considered soft. Nitrogen as ammonia nitrogen was detected only in the SW-01 sample (0.078 mg/L) and is below the CWQG FAL limit (CCME 2024). Total organic carbon ranged from 9.9 to 29 mg/L and total phosphorous was non-detect across the three sites.

Total metals were analysed from the water samples with aluminum (0.054 to 0.250 mg/L) and iron (0.200 to 0.700 mg/L) concentrations exceeding the CWQG FAL in samples SW-01 and SW-03 for Al, and SW-03 for Fe, respectively. No other exceedances of the CWQG-FAL were observed.

5.3.1.2.3 Fish Communities

American eel (*Anguilla rostrata*), gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*), white sucker (*Catostomus commersoni*), banded killifish (*Fundulus diaphanous*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), smallmouth bass (*Micropterus dolomieu*), lake chub (*Couesius plumbeus*), threespine stickleback (*Gasterosteus aculeatus*), fourspine stickleback (*Apeltes quadracus*), ninespine stickleback (*Pungitius pungitius*) and northern redbelly dace (*Chrosomus eos*) are known to occur in the Avon River (Daborn and Brylinsky 2004).

Brook trout (*Salvelinus fontinalis*) and American eel were confirmed present in Sams Brook. Brook trout life stages included young of year and adult (length range 49 to 154 mm). No fish were captured in S2, P1 or P2.

5.3.1.2.4 Species at Risk

Three aquatic SAR/SOCC have the potential to inhabit the Sams Brook sub-watershed: American eel (COSEWIC 2012a), Inner Bay of Fundy (iBoF) Atlantic salmon (COSEWIC 2010) and brook trout (*Salvelinus fontinalis*) (ACCDC 2023). The conservation status for each species is provided in Table 5.3.5.

Table 5.3.5 Freshwater Species at Risk/Species of Special Concern Potentially Occurring within the LAA

Scientific Name	Common Name	SARA	COSEWIC	NS ESA	S-Rank
Anguilla rostrata	American eel	-	TH	-	S3N
*Salmo salar**	Atlantic salmon - Inner Bay of Fundy (iBoF)	EN	EN	-	S1
Salvelinus fontinalis	Brook trout	-	-	-	S3

Notes:
Asterisks(*) indicate SAR
SAR/COSEWIC/NB ESA codes used:
SC = Special Concern; TH = Threatened; VU = Vulnerable; EN = Endangered; NAR = Not at Risk
S-Rank definitions (AC CDC 2024):
S1 = Critically Imperiled: Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S3 = Vulnerable: Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
N = Non-Migratory population

5.3.1.2.5 Fisheries

Recreational fishing Area 5 of Nova Scotia (Annapolis, Hants and Kings Counties) has recreational fisheries for several freshwater fish species including brook trout, brown trout, rainbow trout, smallmouth bass, chain pickerel, white perch and yellow perch (Nova Scotia Department of Fisheries and Aquaculture 2024). The sea-run Atlantic salmon fishery in iBoF rivers has been closed since 1984 (DFO 2010). Sam’s Brook (S1) which is approximately 300 m east of the PDA has the potential to support fish species (American eel, Atlantic salmon, and brook trout) that are a traditional and cultural resource for local Indigenous groups. Hunting and fishing are not currently permitted on Spence property.

5.3.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for the Aquatic Environment is provided in Table 5.3.6. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.3.6 Potential Effects, Effect Pathways and Measurable Parameters for Aquatic Environment

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Surface Water Quantity	Changes to Contributing Watershed Area (i.e., quarrying activities) Changes in flow	Change in annual runoff volumes due to land use changes Loss of fish habitat (m^2)
Change in Quality of the Aquatic Environment (i.e., Surface Water Quality and Fish Habitat Quality)	Erosion and sedimentation Release of deleterious substances Fugitive dust	Water quality, including but not limited to total suspended solids (TSS) (mg/L); dissolved oxygen (DO) (mg/L); water temperature (°C); pH; metals; nutrients Fish habitat (physical characteristics including substrate, velocity, cover)
Change in Fish Health and Survival within the Aquatic Environment	Erosion and sedimentation Release of deleterious substances Blasting	Abundance (numbers of fish) Community structure (proportion of each species) Mortality (numbers of fish)

Pathways that affect the Aquatic Environment are related to potential surface runoff from areas of disturbance or stockpiles, discharge of overland runoff to watercourses and blasting.

In the absence of mitigation, the Project may interact with the Aquatic Environment in the following ways:

- Site preparation and earthworks could increase the potential for changes in runoff (i.e., water quantity), sedimentation, and the introduction of deleterious substances into watercourses, thus reducing fish habitat quality (e.g., siltation of spawning beds)
- Runoff from overburden and stockpiles could affect water quality and thereby affect the aquatic environment
- Operations could result in suspended sediments and dust from the quarry or unpaved roadbed being carried into adjacent waterbodies, thereby affecting the aquatic environment
- Introduction of sediments into the aquatic environment could affect fish health and survival;siltation events could inhibit the ability of fish to forage and cause behavioural or physiological changes in fish and smothering of eggs

- Introduction of deleterious substances (e.g., grease, fuel) from machinery operating near waterbodies or improper storage of hazardous materials could also affect fish health and survival within the aquatic environment
- The use of explosives near watercourses could result in instantaneous changes in pressure, and changes to fish health and survival through injury or instantaneous death

5.3.3 Mitigation and Management Measures

Avoidance measures including physically relocating Project components and activities away from watercourses and waterbodies have reduced potential direct interactions between the Project components or activities on the Aquatic Environment, where practicable. The closest fish-bearing watercourse is Sam's Brook (S1) which is located approximately 300 m from the PDA.

Where work has the potential to interact with riparian areas, DFO's *Measures to Protect Fish and Fish Habitat*", DFO standards and codes of practices and other standard mitigation will be employed to reduce the potential for effects.

The following mitigation measures specific to the Aquatic Environment have been identified for the Project:

- Project footprint and disturbed areas will be limited to the extent practicable.
- Avoid work within 30 m of watercourses or waterbodies.
- Maintain undisturbed vegetated buffers between on-land activities and watercourses.
- Install effective erosion and sediment control (ESC) measures. Inspect and maintain them regularly.
- Keep ESC measures in place until disturbed ground has stabilized.
- Collect and treat contact water as appropriate (i.e., overland runoff).
- Maintain onsite machinery to keep free of fluid leaks.
- Fugitive road dust will be controlled with measures such as road watering on an as-needed basis and speed limits on Project-controlled gravel roads
- Disturbed areas will be revegetated upon site reclamation to limit dust emissions.
- Maintain appropriate watercourse buffers when blasting.

Design mitigation and standard best management practices will also be implemented to avoid or reduce potential effects the Aquatic Environment. A project-specific water management plan will be developed to monitor water quality in the watercourses downstream of Project infrastructure to reduce potential for blasting residuals to reach watercourses and to mitigate for TSS increases to runoff. This plan will be submitted in conjunction with the application for amendment for the existing IA.

5.3.4 Residual Environmental Effects

This section discusses the residual Project-related residual effects to the Aquatic Environment following the application of mitigation in section 5.3.4.

A significant residual adverse effect on the Aquatic Environment for the Project is defined as any of the following:

- Contravention of a watershed management target including:
  - changes to flows that increase erosion and sedimentation above regulatory guidance in waterbodies receiving surface water runoff
  - changes to flows that cause reduction in streamflow to rates below ecological maintenance (i.e., fish habitat and fish passage)
  - changes to water levels outside the PDA to a point that it affects existing ecological functions (i.e., fish passage)
  - degradation of water quality that causes acute toxicity to aquatic life
  - changes the trophic status of a lake or stream
- A Project-related Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or the death of fish, as defined by the *Fisheries Act*, that cannot be mitigated, authorized, or offset
- A change to the productivity or sustainability of fish populations or fisheries within Sams Brook sub-watershed where recovery to baseline is unlikely

5.3.4.1 Change in Surface Water Quantity

For the purpose of this assessment, an expected change in annual runoff greater than 10% within a watershed is considered to be a significant change in surface water quantity. The ± 10% in annual runoff threshold is selected based on case studies presented by Richter et al. (2011), which indicate that a high level of ecological protection is provided when flow alterations are within 10% of the natural flow, and guidance provided by DFO; DFO 2013).

Flows and runoff volumes under pre-development conditions were used as the baseline against which Project-related changes were assessed. To assess potential environmental effects, the water balance model was run on a monthly basis for the post development scenario for each sub-watershed area:(Avon and St. Croix) and compared to the results of the pre-development water balance. The changes to watersheds are attributed to land use changes as quarrying activities are undertaken.

The input parameters included monthly precipitation, temperature, runoff factor, soil moisture storage capacity, and rain and snowfall temperature thresholds. The pre-development input parameters are presented in Table 5.3.7. The change to the runoff factor is attributed to the additional exposed gravel area (quarry) that will be excavated throughout the life of the Project.

Table 5.3.7 Input Parameters for Post-Construction Environmental Water Balance

Input Parameters (units)	Avon Sub-Watershed	St. Croix Sub-Watershed
Runoff Factor (-)	0.5	0.5
Total Water (-)	1	1
Topography Factor	0.1	0.1
Soils Factor (-)	0.2	0.2
Cover Factor (-)	0.2	0.2
Direct Runoff Factor (-)	0.28	0.24
Soil-Moisture Storage Capacity (mm)	300	300
Latitude of Location (degrees)	48	48
Rain-Temperature Threshold (degC)	0	0
Snow-Temperature Threshold (degC)	-5	-5
Maximum melt rate (-)	0.5	0.5

The post-development water balance results for overland flow (i.e., runoff) are presented in Tables 5.3.8 and 5.3.9 with a comparison to the pre-development results, for the Avon and St. Croix watersheds, respectively. Based on the Thornthwaite model, annual overland flow is expected to increase from 388.6 mm to 390.4 mm (Table 5.3.8) under post-development conditions for the Avon watershed. This corresponds to an annual runoff volume increase of 0.5% which falls below the 10% threshold for a significant change to surface water quantity. For the autumn months (August, September, October, and November), increases to runoff are predicted to be above 10% due to the increased area of exposed land (i.e., gravel). These increases in flow may be managed using on site water management infrastructure (i.e., sedimentation ponds) to control outflow leaving the site during these months.

For the St. Croix Sub-watershed, based on a comparison to the pre-development water balance, annual overland flow is expected to increase from 388.3 mm to 388. mm (Table 5.3.9) under post-development conditions. This corresponds to an annual runoff volume increase of 0.1%. For the month of September, an increase to runoff is predicted to be above 10% due to the increased area of exposed land (i.e., gravel). The increase in flow for this month may be managed using on site water management infrastructure (i.e., sedimentation ponds) to control outflow leaving the site in September.

Table 5.3.8 Avon Sub-Watershed - Post-Development Water Balance for the Climate Normal Period from 1991-2020

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pre-Development Runoff (mm)	19.0	13.1	59.2	62.1	45.0	28.3	19.1	16.0	16.9	17.6	40.7	51.5	388.6
Post-Development Runoff (mm)	16.3	11.8	59.6	62.3	45.1	29.6	20.8	18.2	19.9	21.2	36.3	49.0	390.4
Percent Difference (%)	15.3	10.6	0.8	0.4	0.3	4.6	8.7	13.3	16.6	18.2	11.5	5.0	0.5

Table 5.3.9 St. Croix Sub-Watershed – Post-Development Water Balance for the Climate Normal Period from 1991-2020

Parameters (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pre-Development Runoff (mm)	20.0	13.6	58.9	62.0	44.9	27.8	18.4	15.1	15.7	17.8	41.9	52.2	388.3
Post-Development Runoff (mm)	18.5	12.8	59.2	62.2	45.0	28.6	19.4	16.4	17.5	18.4	39.8	51.0	388.9
Percent Difference (%)	7.8	5.9	0.5	0.3	0.1	2.8	5.4	8.8	11.2	3.0	5.1	2.3	0.1

Pathways that affect surface water quantity as outlined in section 5.3.3 are surface runoff (i.e., changes to contributing watershed area land use) from areas of disturbance or stockpiles. In general, the pathways of effects for surface water quantity pertain to changes to land uses (e.g., quarry development) within the Project watersheds.

Changes to land use in the Avon and St. Croix sub-watershed areas were assessed and runoff volumes were calculated for pre- and post-development of the Project site. As these values represent a total change of less than 10% increase in annual runoff, and with the implementation of mitigation listed in section 5.3.4, residual Project related effects are anticipated to be low in magnitude for surface water quantity. On a monthly scale, the predicted increases in flow (greater than 10%) may be managed using on site water management infrastructure (i.e., sedimentation ponds) to control outflow leaving the site during these months, therefore with the implementation of mitigation, residual Project related effects are predicted to be low for monthly surface water quantity

5.3.4.2 Change in Quality of the Aquatic Environment

Pre-development water quality and fish habitat conditions served as the baseline for assessing Project-related changes. A GIS analysis overlaying the Project footprint on mapped watercourses and waterbodies was conducted to delineate potential habitat losses due to infrastructure. Where available, field measurements supplemented this analysis to assess impacts on fish habitat and water quality.

Pathways that affect Aquatic Environment quality as outlined in section 5.3.3 are surface runoff (i.e., sedimentation) from areas of disturbance or stockpiles, and blasting. In general, the pathways of effects for fish habitat quality can also affect fish health and survival.

The Project has been designed to avoid these pathways to the extent practicable through shifting the placement of infrastructure and activities away from watercourses, maintaining a minimum 30 m buffer around watercourses (approximately 300 m from the closest fish-bearing watercourse) and collection of surface water runoff from disturbed areas or piles. The site Water Management Plan that will be developed for the site will include monitoring of water quality downstream of the Project compared with CWQG-FAL including blasting residuals.

Mitigation (section 5.3.4) will be used to reduce the potential for effects. Potential interactions for fish and fish habitat are well known and documented. With avoidance and the application of DFO's *Measures to Protect Fish and Fish Habitat* (DFO 2023), codes of practice and mitigation listed in section 5.3.4, residual Project related effects are anticipated to be low in magnitude for fish habitat quality and surface water quality.

5.3.4.3 Change in Fish Health and Survival

Qualitative assessments were conducted using professional judgement based on an understanding of the Project and potential effects, the habitat use and life history of potentially affected fish species in the area, and the likely effectiveness of mitigation measures. This is supported by scientific literature, industry best management practices, and regulatory guidelines, as available.

Pathways that affect fish health and survival as outlined in section 5.3.3 are related to sedimentation associated with site preparation/exposed soils, introduction of deleterious substances through use of machinery and use of explosives near water.

The Project has been designed to avoid these pathways to the extent practicable through shifting the placement of infrastructure and activities away from watercourses, maintaining a minimum 30 m buffer around watercourses, collection of surface water runoff from disturbed areas or piles and appropriate buffers for blasting. Given that the closest fish-bearing watercourse (i.e., Sam's Brook) is located approximately 300 m from the PDA effects to fish health and survival are not anticipated. As described in section 5.3.4., mitigation will be used to reduce the potential for effects. Potential interactions for fish health and survival are well known and documented. Consequently, with avoidance and the application of DFO's *Measures to Protect Fish and Fish Habitat* (DFO 2023), codes of practice and mitigation listed in section 5.3.4, residual Project related effects are anticipated to be low in magnitude for fish health and survival. A follow-up Water Quality Monitoring Plan will be established and submitted as part of the application for amendment for the existing IA to monitor for blasting residuals within nearby watercourses.

5.3.4.4 Summary

The Project has been designed to avoid effects to the Aquatic Environment through planning and placement of infrastructure and avoiding activities near watercourses. The closest fish-bearing watercourse is Sam's Brook (S1) which is located approximately 300 m from the PDA. Where work has the potential to interact with riparian areas, DFO's *Measures to Protect Fish and Fish Habitat*, DFO standards and codes of practices and other standard mitigation will be employed to reduce the potential for effects. The potential effects to surface water quantity were assessed using desktop modelling of land use changes to the contributing watershed area. As these changes represented an estimated increase in runoff of 6.0 to 8.4%, the resulting effects to surface water quantity are predicted to be not significant. With avoidance and mitigation measures in place, the residual adverse environmental effects on fish and fish habitat and surface water quality are predicted to be not significant. This determination is made with a high level of confidence, given that watercourses will be avoided and best management practices and standard mitigation will be in place.

5.3.5 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for the Aquatic Environment VC. A project-specific Water Management Plan will be developed as part of the application for amendment for the existing IA to reduce the potential for excessive TSS and blasting residuals to reach watercourses.

5.4 Vegetation and Wetlands

Vegetation and Wetlands is selected as a VC because of the potential for interactions between Project activities and vegetation and wetlands. Wetlands have environmental, aesthetic, recreational, and socio-economic value to the people of Nova Scotia and are protected by the *Environment Act*. This VC will focus on loss of wetland habitat and plant SAR and SOCC. In addition to some legal protection offered to some plant species, they are also included as a VC because of the intrinsic value of these plants and their habitats (vegetation communities) for biodiversity. SAR and SOCC are often associated with rare or unusual microsites.

A significant adverse environmental effect on vegetation and wetlands is one that, following the application of avoidance and mitigation measures, threatens the long-term viability or persistence of plant communities or species, including those of cultural or traditional importance, or results in uncompensated loss of wetland function.

The LAA is considered to be a buffer of 180 metres (m) from the boundary of the PDA in all directions, representing the maximum potential distance of edge effects in temperate ecosystems (Franklin et al. 2021). Temporal boundaries are continuous throughout the life of Project operations including and reclamation activities.

SAR are those species listed on Schedule 1 of the federal SARA as being either endangered, threatened, or vulnerable or under the NS ESA. There is both federal (SARA) and provincial (NS ESA) legislation for the protection of SAR.

SOCC are rare species that are not protected by SARA or the NS ESA and include those that are identified by COSEWIC as being either endangered, threatened, or of special concern and those ranked as S1, S2, or S3 by the AC CDC (AC CDC 2025a).

The occurrence of rare species (i.e., SAR or SOCC) within wetlands is also of concern with respect to provincial wetland policy and the permitting process.

Plant communities of conservation concern have not been similarly classified under provincial legislation or policy. Therefore, the identification of “uncommon plant communities” is based on general knowledge of the distribution of vegetation within the province and the occurrence of species assemblages. For the purposes of this assessment, an uncommon plant community is defined as an area that supports an assemblage of native vascular plants which are not commonly encountered within the province, and which occur as a result of unique natural processes and/or environmental conditions. Examples of uncommon plant communities within the province may include those associated with karst topography, old growth forests, eastern white cedar (*Thuja occidentalis*) stands, rich riparian forests, and alkaline fens. These communities have no legislative protection.

Wetlands in Nova Scotia are protected by the provincial *Environment Act*, where “wetland” is defined as:

> *land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land’s surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.*

The Nova Scotia Wetland Conservation Policy (GNS 2011) provides context to legislation, regulations and operational policies designed to protect and guide the management of wetlands in Nova Scotia. The policy establishes a specific goal of no loss of Wetlands of Special Significance and no net loss in area and function for other wetlands. The government considers the following to be Wetlands of Special Significance (GNS 2011):

- All salt marshes
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Area or lands owned or legally protected by non-government charitable conservation land trusts
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the Nova Scotia Eastern Habitat Joint Venture
- Wetlands known to support at-risk species as designated under the SARA or the NS ESA
- Wetlands in designated protected water areas as described within section 106 of the *Environment Act*

Any project with the potential to alter a wetland (filling, draining, flooding or excavating), including direct and indirect effects, requires an approval from NSECC, pursuant to the Activities Designation Regulations, prior to starting the work. If alterations exceed two hectares of any wetland, the project is also subject to registration under the Environmental Assessment Regulations.

5.4.1 Existing Conditions

The Project is located south of Newport Station in West Hants Regional Municipality. It is near the western edge of the Eastern Ecoregion in the Rawdon/Wittenburg Hills Ecodistrict (NSDNR 2017). The PDA is approximately 63.3 ha and includes two pits, one of which is active.

5.4.1.1 Approach and Methods

Vegetation within the PDA was evaluated using available desktop information and field surveys. The following information sources were reviewed prior to conducting field surveys: existing AC CDC data (AC CDC 2023), aerial and satellite imagery (including LiDAR), provincial forestry data (NSDNR 2012) and wetland mapping, the provincial Significant Species and Habitats Database and Boreal Felt Lichen Habitat Modelling (NSDNR 2018).

A three-day field survey occurred during the week of July 22 to July 26, 2024, to capture the majority of rare or sensitive vascular plant species potentially present in the PDA. Field surveys focused on documenting the distribution and abundance of any vascular plant SAR and SOCC observed within the PDA, describing the dominant vegetative communities, and obtaining information on other important features (e.g., rare or unique habitats, concentrations of invasive plants). A dedicated survey for non-vascular plant SAR/SOCC was not carried out during field surveys. While information gathered during the 2023 constraints analysis includes records of non-vascular SAR and SOCC within 5 km of the Project Area, information regarding forestry activities and habitat quality suggests that habitat in the Project Area is likely not suitable for most non-vascular SAR and SOCC.

A review of provincial wetland mapping did not identify wetlands within the Project Area; however, it is Stantec's experience that unmapped wetlands are frequently detected through field surveys. A two-day field survey was completed the week of July 22 to July 26, 2024, to evaluate field conditions and determine the potential occurrence of unmapped wetlands within the Project Area. A final day to finish remaining wetland boundaries was completed by two wetland delineators on September 11, 2024. Boundaries of wetlands within this area were delineated following principles outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Northcentral and Northeast Regional Supplement (U.S. Army Corps of Engineers 2012). Delineation data forms documenting vegetation and hydrology information were completed at upland and wetland plots for each wetland during 2024 field surveys. Soil pits were not completed during 2024 field surveys but will be completed in advance of wetland permitting.

Functional assessments of wetlands within the PDA were not conducted during 2024 field surveys but will be completed during the permitting stage and will use the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) method (NBDELG 2018). Surveys for plant and animal SAR and SOCC were recorded within wetlands during the surveys; this information will be used to support the functional assessment.

5.4.1.2 Description of Existing Conditions

Prior to field work, Stantec reviewed AC CDC data records to determine the rare vascular plant species known to occur within 5 km of the Project (Table 5.4.1).

Table 5.4.1 AC CDC Data Records of Known Rare Vascular Plants within 5 km of the Project

Scientific Name	Common Name	COSEWIC	NS ESA	SARA	S Rank
Fraxinus nigra	black ash	TH	TH	-	S1S2
Cypripedium arietinum	ram's-head lady's-slipper	-	EN	-	S1S2
Antennaria parlinii ssp. *fallax*	Parlin's pussytoes	-	-	-	S2
Rudbeckia laciniata	cut-leaved coneflower	-	-	-	S2
Anemonastrum canadense	Canada anemone	-	-	-	S2
Hepatica americana	round-lobed hepatica	-	-	-	S2

Table 5.4.1 AC CDC Data Records of Known Rare Vascular Plants within 5 km of the Project

Scientific Name	Common Name	COSEWIC	NS ESA	SARA	S Rank
Dirca palustris	eastern leatherwood	-	-	-	S2
Lilium canadense	Canada lily	-	-	-	S2
Cypripedium parviflorum var. *pubescens*	yellow lady's-slipper	-	-	-	S2
Cypripedium parviflorum var. *makasin*	small yellow lady's-slipper	-	-	-	S2
Crataegus submollis	Quebec hawthorn	-	-	-	S2?
Thuja occidentalis	Eastern white cedar	-	VU	-	S2S3
Oenothera fruticosa ssp. *tetragona*	narrow-leaved evening primrose	-	-	-	S2S3
Rumex triangulivalvis	triangular-valve dock	-	-	-	S2S3
Eleocharis ovata	ovate spikerush	-	-	-	S2S3
Iva frutescens	big-leaved marsh-elder	-	-	-	S3
Symphyotrichum undulatum	wavy-leaved aster	-	-	-	S3
Triosteum aurantiacum	orange-fruited tinker's weed	-	-	-	S3
Laportea canadensis	Canada wood nettle	-	-	-	S3
Carex bebbii	Bebb's sedge	-	-	-	S3
Carex cryptolepis	hidden-scaled sedge	-	-	-	S3
Carex rosea	rosy sedge	-	-	-	S3
Carex tribuloides	blunt broom sedge	-	-	-	S3
Carex tuckermanii	Tuckerman's sedge	-	-	-	S3
Platanthera hookeri	Hooker's orchid	-	-	-	S3
Persicaria amphibia var. *emersa*	long-root smartweed	-	-	-	S3?

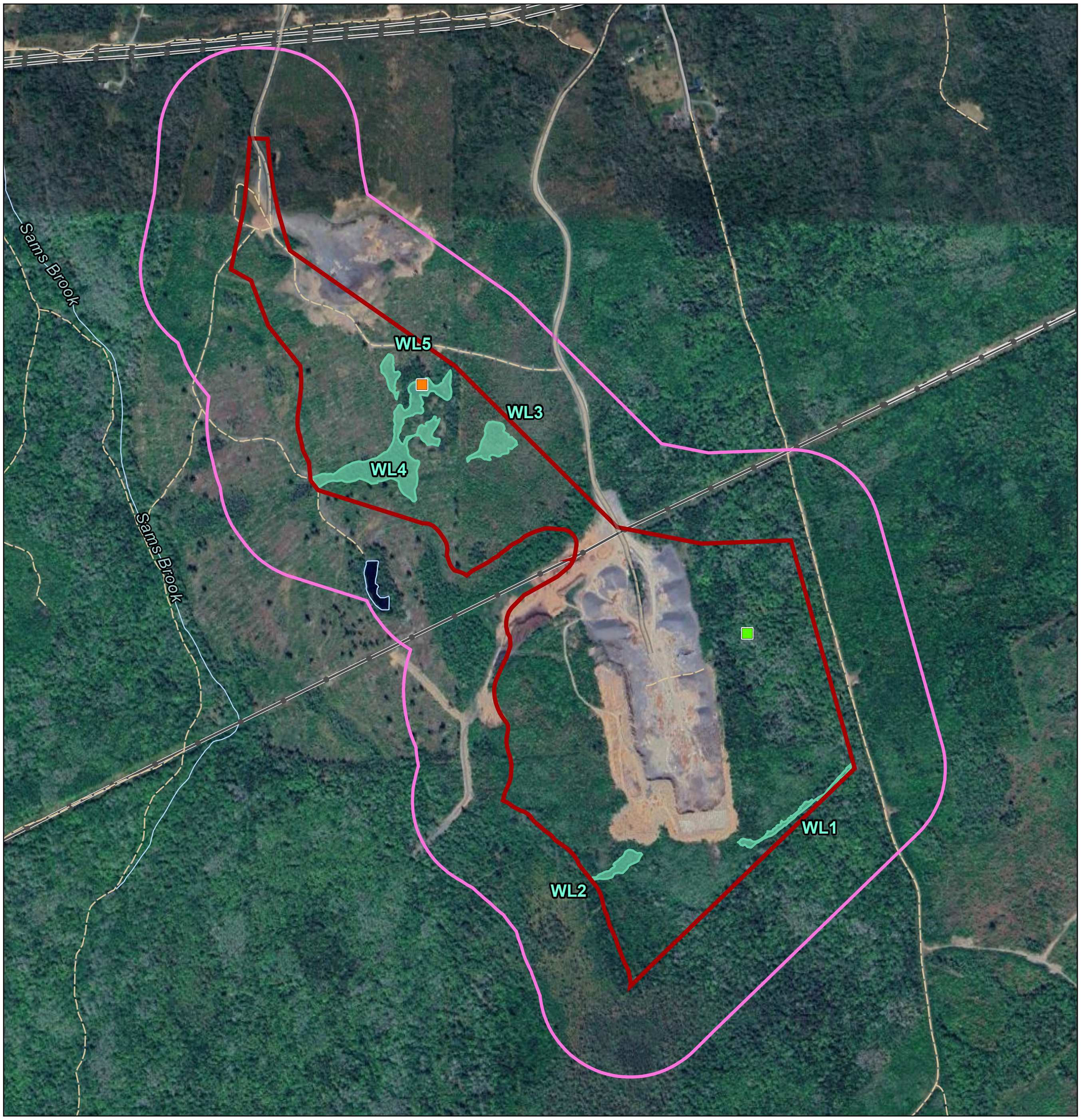
Notes:
SAR/COSEWIC/NS ESA codes used:
SC = Special Concern; TH = Threatened; VU = Vulnerable; EN = Endangered; NAR = Not at Risk
S-Rank definitions (AC CDC 2025b):
S1 = Critically Imperiled: Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 = Imperiled: Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 = Vulnerable: Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 = Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 = Secure: Common, widespread, and abundant in the province.
SNR = Unranked: Nation or state/province conservation status not yet assessed.
SNA = A conservation status rank is not applicable because the species is not a suitable target for conservation activities

5.4.1.2.1 Vegetation

A total of 150 vascular plant species were identified within the PDA (Appendix B, Table B.1). There were no SAR species identified within the PDA. Two vascular plant SOCC were observed within the PDA: downy rattlesnake-plantain (*Goodyera pubescens*), and Hooker's orchid (*Platanthera hookeri*) (Table 5.4.2, Figure 5.4.1). The remainder of observed plants are ranked S4 or lower and are considered apparently secure to secure, and common in Nova Scotia.

Table 5.4.2 Vascular Plant SOCC Observations within the PDA

Scientific Name	Common Name	COSEWIC	NS ESA	SARA	S Rank
Goodyera pubescens	Downy Rattlesnake-Plantain	-	-	-	S2S3
Platanthera hookeri	Hooker's Orchid	-	-	-	S3



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Google, Esri Community Maps Contributors, Province of New Brunswick, Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NRCan, Parks Canada

Project Development Area (PDA)
Local Assessment Area
Species of Conservation Concern
Hooker's Orchid *Platanthera hookeri*
Downy Rattlesnake-Plantain, *Goodyera pubescens*

Local Road
Resource Road / Trail
Transmission Line
Watercourse
Waterbody
Wetland (Field Delineated)

0 200 400 Metres
(At original document size of 8.5x11)
1:12,000

N

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by MB on 2025-02-06

Client/Project
Spence Aggregates Limited
Spence Quarry
Expansion

121418141_006

Figure No.
5.4.1

Title
Wetlands and Observed Vascular Plant SOCCs

\\ca0213-ppfss01\work_group\1214\active\1XXX - Other PCs\1214_NB\121418033\gis\mapping\aprx\121418141_Spence_Quarry_Expansion\121418141_Spence_Quarry_Expansion.aprx Revised: 2025-04-09 By: schubbs

No lichen surveys were conducted. Boreal felt lichen (*Erioderma pedicellatum*) is not expected to occur in the area and there are no predictive Boreal Felt Lichen Habitat Model polygons within the PDA (Cameron and Neily 2008).

Many of the plant communities encountered within the PDA are common within the province and show evidence of recent or historical disturbance. There is no evidence of karst topography, eastern white cedar-dominated forest stands, or alkaline fens. There are no confirmed old growth stands currently within the PDA. With much of the PDA having previous disturbance from clear cutting and current quarry activity, these areas are not expected to mature into old growth forest in the near future.

Vegetation communities and other land use types within the PDA as mapped by NSDNRR are presented in Table 5.4.3.

Table 5.4.3 Vegetation Communities and Other Land Use within the PDA

Land Use	Area (ha)	% of PDA
Anthropogenic (existing gravel pit, transmission line, etc.)	19.1	30.2
Regenerating Forest	26.0	41.1
Young/Immature Hardwood	0.1	0.1
Mature Hardwood	3.7	5.9
Young/Immature Mixedwood	6.0	9.5
Mature Mixedwood	5.8	9.2
Mature Softwood	0.1	0.2
Waterbody	0.01	0.01
Wetland (field-delineated)	2.44	3.9
Total	63.3	-

Vegetation communities to the east of the current quarry operations are mature mixedwood forests estimated to be approximately 60 years old. The northern half of this area is stoney but has mesic soil conditions. It has an overstory dominated by large tooth aspen (*Populus grandidentata*), red maple (*Acer rubrum*), red oak (*Quercus rubra*) and balsam fir (*Abies balsamea*). The shrub understory is dominated by balsam fir, red spruce (*Picea rubens*), striped maple (*Acer pensylvanicum*), Canada fly honeysuckle (*Lonicera canadensis*), and beaked hazel (*Corylus cornuta*). Ground vegetation is composed of (*Amauropelta noveboracensis*), wild sarsaparilla (*Aralia nudicaulis*), christmas fern (*Polystichum acrostichoides*), yellow bluebead lily (*Clintonia borealis*), and twinflower (*Lysimachia borealis*). The southern portion of this area is less fertile than the northern portion. The overstory is dominated by red spruce, red maple, white pine (*Pinus strobus*), white birch (*Betula papyifera*) and red oak. The understory is comprised of regenerating trees such as red spruce and balsam fir. Ground vegetation is comprised of Schrebers moss (*Pleurozium schreberi*), broom mosses (*Dicranum* spp), three-lobed whipwort (*Bazzania trilobata*), bunchberry (*Cornus canadensis*), wild lily-of-the-valley (*Maianthemum canadense*), and goldthread (*Coptis trifolia*).

The area south and west of the current quarry operations is an immature mixedwood forest around 12 years old. The forest occurs on stony and well drained soils. The tree and shrub layers are relatively sparse and composed of large tooth aspen, white pine, red spruce, and red maple. The ground vegetation is composed of bracken fern (*Pteridium aquilinum*), sheep laurel (*Kalmia angustifolia*), bunchberry, and wild lily-of-the-valley.

The vegetation communities in the regenerating areas that had previously been clear cut located northwest of the current quarry operations have a similar composition to the areas south and west of the current quarry operation with immature mixedwood forests with stony well drained soils and ages ranging from around 10 to 20 years old. The tree and shrub layer are relatively sparse and composed of large tooth aspen and trembling aspen (*Populus tremuloides*), white pine, red spruce, and red maple.

Vegetation communities in wetlands are described below.

5.4.1.2.2 Wetlands

Five wetlands were encountered within the PDA during field surveys. Each field-delineated wetland has been classified by class and type according to the Canadian Wetland Classification System (Table 5.4.4). During the preliminary assessment, wetland boundaries adjacent to some portions of the PDA were noted and the PDA was adjusted to avoid these wetlands where possible with 30 m buffers, to reduce potential effects to wetlands.

Table 5.4.4 Wetland Areas and Types in the PDA

Wetland ID	Wetland Class and Type[1]	Total Wetland Area (ha)	Percent of Total PDA Area	Provincially Identified WSS[2]
WL1	Mixedwood Treed Swamp	0.19	>1%	N
WL2	Deciduous Treed Swamp	0.19	>1%	N
WL3	Coniferous Treed Bog	0.37	>1%	N
WL4	Complex - Mixedwood treed swamp, treed bog	1.55	2.5%	N
WL5	Marsh	0.15	>1%	N
Total		2.45	3.9%	-

Note:
[1] Wetland classes and types were field identified.
[2] Wetland of Special Significance

Descriptions of Wetland Classes

Wetlands in the PDA have been categorized into three classes with types, when appropriate, and described based on the Canadian Wetland Classification System (NWWG 1997). These groups include marsh, bog and swamp.

Marsh

Marshes typically have shallow, but fluctuating water levels and are typically dominated by graminoid species including grasses, sedges (*Carex* spp.), cattails (*Typha* spp.), or rushes (*Juncus* spp.), and may include some shrub cover. The fluctuating water levels and changes in water depth and duration of flooding often result in distinct zones of vegetation (NWWG 1997). Marshes are often associated with high species diversity, while many of the marshes within the PDA are a result of disturbance activity creating large pools of water and increasing the abundance of graminoid cover. The post disturbance communities found in these marshes are relatively simple and dominated by broad leaved cattail (*Typha latifolia*).

Bog

Bogs are peatlands that have the water table at or near the peat surface. The bog surface is virtually unaffected by nutrient enriched groundwater from the surrounding mineral soils. Bogs are typically acidic and nutrient deficient. The dominant substrates of bogs are weakly to moderately decomposed sphagnum and woody peat that may occasionally be underlain by peat derived from sedges. Bogs may be treed or treeless and are usually occupied by various species of peatmoss (*Sphagnum* spp.) and ericaceous shrubs (NWWG 1997). Bogs within the PDA are treed.

Treed Bog

The sparse overstory composed of black spruce (*Picea mariana*) and red maple. The shrub is also sparse with less than 20% cover and comprises regenerating trees from the tree layer as well as ericaceous shrubs and willows (*Salix* spp). The herb layer often contains graminoids such as common woolly bulrush (*Scirpus cyperinus*) and tawny cottongrass (*Eriophirum virginicum*) while the bryophyte layer is dominated by peat mosses.

Swamp

Swamps are mineral wetlands or peatlands with standing water or water flowing slowly through pools or channels (NWWG1997). Treed swamp wetlands are generally dominated by at least 30% woody vegetation cover comprised of trees or tall shrubs and may occur on organic or mineral soils influenced by minerotrophic groundwater (NWWG 1997). The water table is typically at or near the soil surface and they are not as wet as marshes, fens, or bogs. Treed swamps are the most abundant class in the PDA.

Mixedwood Treed Swamp

The overstory primarily comprises red maple, balsam fir, red spruce, black spruce, and white ash (*Fraxinus americana*). The shrub layer often comprised regenerating trees from the tree layer as well as other species such as aspen (*Populus grandidentata* and *P. tremuloides*) or speckled alder (*Alnus incana*). The herb layer often contains many fern species such as cinnamon fern (*Osmundastrum cinnamomeum*) and sensitive fern (*Onoclea sensibilis*) as well as a variety of graminoid species, while the bryophyte layer is most often dominated by peat mosses.

Deciduous Treed Swamp

The overstory primarily comprises red maple, white ash, red spruce, and balsam fir. The shrub layer often comprised regenerating trees from the tree layer as well as other species such as (*Ilex verticillata*) or alder (*Alnus incana*). The herb layer often contains many fern species such as cinnamon fern and sensitive fern, while the bryophyte layer is most often dominated by peat mosses.

5.4.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Vegetation and Wetlands is provided in Table 5.4.5. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.4.5 Potential Effects, Effect Pathways and Measurable Parameters for Vegetation and Wetlands

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in species diversity	Vegetation clearing and ground disturbance within the PDA may result in direct (e.g., physical disturbance) and indirect (e.g., hydrological changes to habitats) effects on plant SAR or SOCC	Changes to vascular plant or lichen SAR or SOCC (number of individuals or populations)
Change in wetland area or function	Vegetation clearing and ground disturbance within the PDA may change wetland area or function, either directly due to disturbance, or indirectly due to changes in hydrology	Loss of wetland area (ha)

The Project will interact with the vegetation and wetlands resulting in a change in species diversity and wetland area or function as a result of the following activities:

- Clearing and grubbing will remove plant species (and potentially SAR and SOCC) and vegetation communities, disturb soils, and alter wetland function where wetlands are intersected.
- Edge effects resulting from vegetation removal and ground disturbance may affect species diversity and wetlands in areas adjacent to the PDA, particularly where topography, soils or vegetation are altered near wetlands.

- Project activities have the potential to introduce invasive plant species brought in by machinery and construction equipment, or to spread existing invasive plant species to adjacent areas in the LAA.
- Project activities can lead to direct loss of wetland within the PDA and could cause temporary and long-term disturbance to wetlands adjacent or bordering the PDA.
- Project-related changes in hydrology such as impoundment or drainage can lead to indirect loss of wetland area and change in wetland function near the PDA.
- Sedimentation of wetlands or watercourses resulting from operation activities could alter soil conditions or smother wetland or aquatic habitats that support plant species of conservation interest.
- During the operational phase of the Project, the maintenance of the PDA will inhibit the natural succession of plant communities in the PDA throughout the life of the Project.
- During operation the generation of dust from Project activities such as blasting and crushing, and along access roads could affect wetlands and vegetation within and adjacent to the PDA.

5.4.3 Mitigation and Management Measures

The following mitigation measures specific to Vegetation and Wetlands have been identified for the Project:

- Areas of vegetation clearing, grubbing, and other physical disturbances will be limited to the extent practicable and confined to the PDA.
- The boundaries of areas to be cleared will be well-marked prior to the start of clearing activities.
- All equipment will arrive at the site clean and free of soil or vegetative debris to avoid introduction of invasive species.
- Vehicles and equipment will be operated on previously disturbed areas and outside of wetland buffers, wherever feasible.
- Best management practices as described in an Environmental Management Plan (EMP) will be followed to protect watercourses and surrounding wetlands from erosion and siltation.
- Grading will be reduced within wetland boundaries and temporary workspace will not be located within the boundaries of wetlands, unless required for site-specific purposes.
- Grading in upland areas will be directed away from wetlands, where possible.
- Storage of hazardous products and fueling and servicing of equipment will occur more than 100 m from watercourses, waterbodies, and wetlands.
- Temporarily disturbed areas will be returned to pre-operation conditions.

- If invasive species are noted within or near the PDA during operation, the extent of the species will be assessed and a plan for removal and/or control will be developed.
- Wetland alteration permits will be obtained from NSECC for any permanent loss of wetland area or function as a result of the Project. Compensation for direct wetland area loss will be arranged through the provincial wetland permitting process.

Design mitigation and standard best management practices will be implemented to avoid or reduce potential effects on Vegetation and Wetlands.

5.4.4 Residual Environmental Effects

The Project will result in a direct and permanent loss of vegetation and wetlands within much of the PDA. However, with the application of mitigation measures listed above in section 5.4.4, the potential effects on vegetation and wetlands in temporary work areas are expected to be temporary and potentially reversible.

Avoidance and mitigation measures outlined above will be completed to the extent feasible; however, effects on vegetation and wetlands within temporary work areas may still occur because of the uncertainty of success of reclamation techniques, and unforeseen natural events or processes.

5.4.4.1 Change in Species Diversity

The progressive removal of vegetation through clearing and grubbing as the quarry expands will result in the direct mortality of any vegetation that may be located within the expanded area, potentially including SAR and SOCC. Clearing will remove trees and shrubs and damage other remaining understory vegetation. Grubbing will completely remove vegetation and some soil from the PDA. This will result in residual effects to remaining plant communities within the PDA and indirect effects to adjacent plants and vegetation communities through edge effects and changes in hydrology. If the entire 63.3 ha PDA is eventually developed, this will result in the loss off approximately 40 ha of upland vegetation communities and 2.44 ha of wetland vegetation communities.

There were two SOCC observed within the PDA: downy rattlesnake-plantain (*Goodyera pubescens*), and Hooker's orchid (*Platanthera hookeri*). Downy rattlesnake-plantain was observed in one location in WL5, and Hooker's orchid was observed once east of the current quarry operation (Figure 5.4.1). Both of these plant occurrences are expected to be lost as a result of the Project; however, it is expected that both species will be retained in the surrounding region. AC CDC data indicates 31 records of downy rattlesnake plantain and 44 records of Hooker's orchid within 100 km of the PDA. Hooker's orchid has also been observed within 5 km of the Project, though this record is from 1952 (AC CDC 2023).

Boreal felt lichen (*Erioderma pedicellatum*) is not expected to occur within or near the PDA as it is farther than 25 km from the Atlantic Ocean (excludes the Bay of Fundy). Provincial guidance requires further surveys if modelled boreal felt lichen polygons occur within 100 m of project activities (NSDNR 2018).

Though no invasive species were observed within the PDA, machinery entering the site can introduce invasive species to the PDA and surrounding LAA. Although it is not expected that any vegetation will establish in the operational quarry, the project could lead to introduction of invasive species in the adjacent LAA. The planned mitigation should reduce the likelihood of introduction.

5.4.4.2 Change in Wetland Area or Function

Within the PDA, where it is not possible to avoid wetlands, grubbing will completely remove wetland vegetation and some soil. Machinery working on site will compact remaining soil layers which can result in a change in wetland hydrology. Sedimentation of wetlands or watercourses from construction activities could alter soil conditions or smother vegetation within wetland or aquatic habitats in the PDA. However, mitigation measures under the EMP are expected to reduce the risk of this occurring.

Within the PDA, a total of 2.44 hectares of wetland will be directly affected by the Project. This impact is expected to be restricted to a series of construction events during gradual expansion of the quarry. Permanently lost wetland within the PDA and changes in grade that prevent wetland recovery will be compensated for according to a wetland compensation plan developed in cooperation with NSECC during the permitting process in advance of wetland disturbance. The successful completion of a wetland alteration permit and subsequent compensation will result in no net loss of wetland area and function. Of the five wetlands within the PDA, none are considered Wetlands of Special Significance.

Wetlands altered by the Project may have indirect effects on wetland area that is outside of the PDA through changes in hydrology caused by ground disturbance. These potential effects will be reduced by mitigation techniques described in section 5.4.4, and through the wetland alteration permitting process.

5.4.4.3 Summary

The Project is anticipated to result in residual effects to vegetation but those are expected to be limited to the expanded quarry footprint or the PDA and are not expected to threaten the long-term persistence of viability of vegetation species in the surrounding region. The Project is expected to impact 2.44 ha of wetlandsbut with the implementation of the mitigation measures outlined above, including compensation, the Project is not expected to result in a net loss of wetland area or function. Considering the limited nature of the expected residual effects, these are predicted to be not significant.

5.4.5 Follow-up and Monitoring Programs

Prior to quarry expansion, further field surveys may be warranted and will be completed during the permitting process to provide the following information:

- Wetland delineation will be completed, with three-parameter upland and wetland plots as seen on the Nova Scotia wetland delineation form. Functional assessments will be completed within a year prior to the submission of permitting applications.
- A wetland monitoring plan will be developed and submitted to NSECC as part of the wetland alteration permit for the Project.

5.5 Wildlife and Wildlife Habitat

Wildlife and Wildlife Habitat was selected as a VC because of potential Project interactions with wildlife (e.g., birds, mammals, herptiles) and associated habitats, particularly with respect to SAR or SOCC. The wildlife and wildlife habitat VC includes baseline descriptions characterising the wildlife and dominant habitats in the PDA.

Spatial boundaries for the assessment of wildlife include wildlife and their habitat occurring within or immediately adjacent to the PDA that could be disturbed by direct Project activities (e.g., clearing, blasting), or indirect Project activities (e.g., noise, vibrations). The LAA is considered to be 500 m from the boundary of the PDA in all directions. Temporal boundaries are continuous throughout the life of Project operations including and reclamation activities.

A significant adverse residual effect on Wildlife and Wildlife Habitat is one that, following the application of avoidance and mitigation measures, causes or further contributes to the exceedance of a conservation-based threshold or threatens the long-term persistence or viability of species of management concern, or species of cultural or traditional importance.

Provincial and federal legislation addresses protection of many wildlife species, including species at risk and migratory birds. Additional detail on wildlife habitat, including descriptions of plant community composition and structure, is available in Vegetation and Wetlands (section 5.4).

Wildlife species that are protected federally under the *Species at Risk Act* (SARA) are listed in Schedule 1 of the Act. Those species listed as “Endangered” or “Threatened” in Schedule 2 or 3 of the SARA may also be considered as Species at Risk, pending regulatory consultation.

Certain wildlife species are also protected under the Nova Scotia *Endangered Species Act* (NS ESA). Species identified as seriously at risk of extinction in Nova Scotia are identified by a provincial status assessment process through the Nova Scotia Endangered Species Working Group. Once identified, they are protected under the NS ESA. The conservation and recovery of species assessed and legally listed under the NS ESA is coordinated by the Wildlife Division of the Nova Scotia Department of Natural Resources and Renewables (NSNRR).

The *Migratory Birds Convention Act, 1994* (MBCA) provides protection for migratory birds on federal, provincial, and private lands. Most migratory species that are native or naturally occurring in Canada are protected; species and species groups are further defined in section 2 of the Act. These protections include a prohibition on depositing harmful substances in areas frequented by migratory birds, and a prohibition on disturbing, destroying, taking, or possessing migratory birds, their nests, and eggs.

Recent changes to the MBCA have updated and clarified the long-standing Migratory Bird Regulations with regards to the protections afforded to the nests of migratory bird species, The new regulations, known as the Migratory Bird Regulations, 2022, establish a list of species (Schedule 1) that continue to have year-round protection for their nests, unless the nests are determined to be abandoned. It also establishes the protocol and waiting period for determining a Schedule 1 species nest to be abandoned. All species protected under the MBCA continue to have their nests protected when they contain a live bird or a viable egg, but the protection does not continue outside the nesting period for species not listed on Schedule 1 of the MBCA.

5.5.1 Existing Conditions

5.5.1.1 Approach and Methods

Information regarding wildlife and wildlife habitat in the vicinity of the PDA has been obtained from field surveys and through published sources including a review of the AC CDC database (AC CDC 2023), Important Bird Areas (IBA) mapping (Bird Studies Canada 2024), and the provincial Significant Species and Habitats Database and other data available from the Provincial Landscape Viewer (NSNRR 2024).

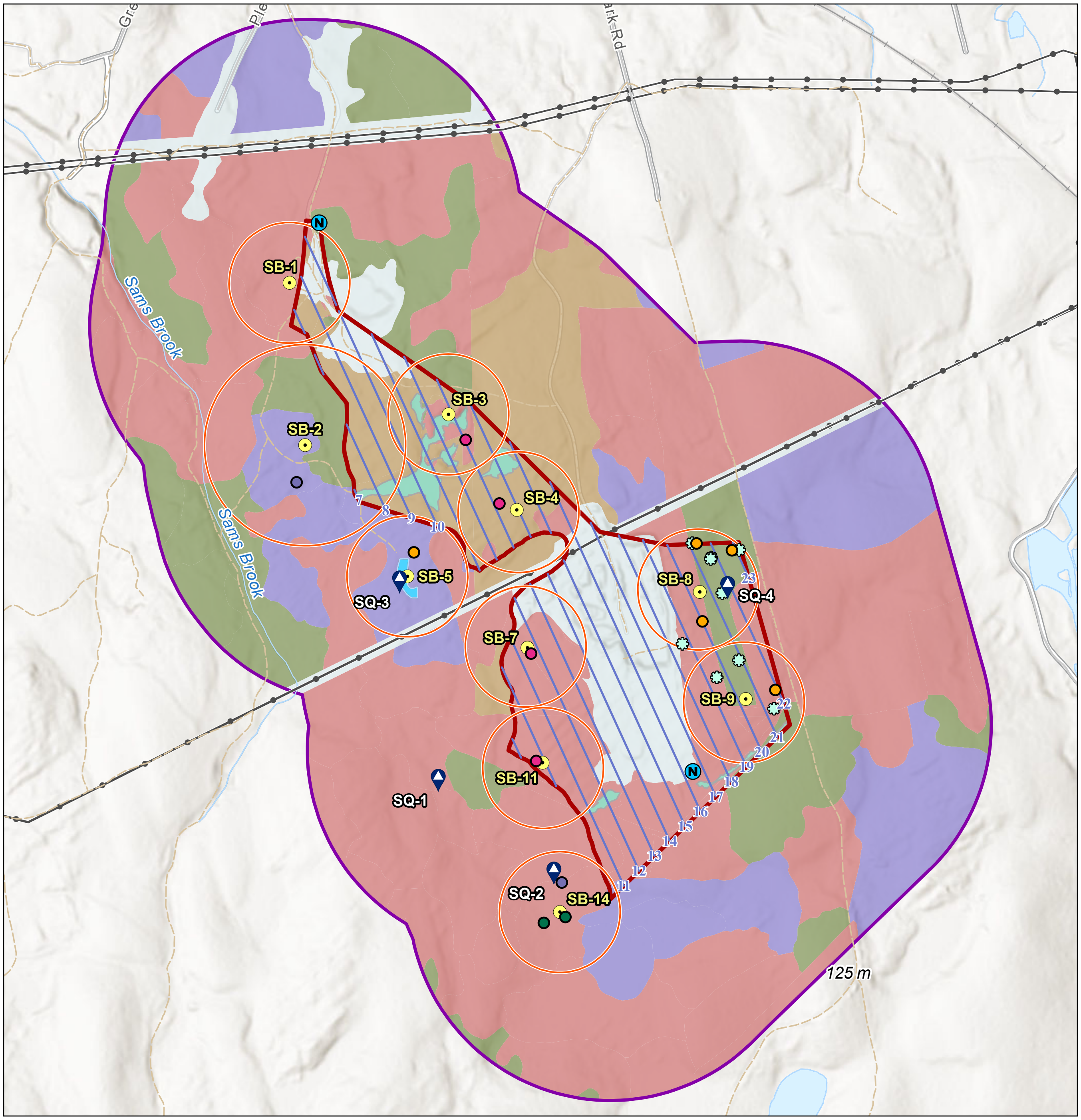
Field surveys included breeding bird point count surveys, dedicated surveys for nightjars, habitat assessments specifically evaluating bat habitat, and acoustic bat surveys. Incidental observations of other wildlife were also recorded. Additional focus during the bat habitat survey was given to identifying the nest cavities and breeding locations of Pileated Woodpeckers (*Dryocopus pileatus*). Of the 18 species of migratory birds identified on Schedule 1 of the Migratory Bird Regulations 2022, Pileated Woodpecker is the only species with some potential to nest within the Study Area.

5.5.1.2 Field Methods

Spence Aggregates contracted Stantec to carry out avifauna and bat surveys in the project area. Surveys were designed considering current Canadian Wildlife Service (CWS) guidance (CWS 2022). Survey locations were selected to cover a representative cross-section of the habitats in the PDA and LAA.

5.5.1.2.1 Pileated Woodpecker Habitat Surveys

Pileated Woodpecker Habitat Surveys were conducted on April 10, 2024. A team of two Stantec biologists assessed the PDA for nesting, roosting, and foraging Pileated Woodpecker cavities in trees which can be identified per the Pileated Woodpecker Cavity Identification Guide (ECCC 2023). Forest inventory data for the PDA was reviewed to identify mature forest stands that could provide suitable nesting habitat for pileated woodpeckers. A series of parallel transects running north to south and 50 m apart were walked by a survey team (Figure 5.5.1). All sightings of pileated woodpeckers were recorded along with any evidence of nesting activity. Suitable nest trees were inspected and any evidence of pileated woodpecker foraging, roosting or nesting activities as indicated by their workings were documented as per the Pileated Woodpecker Cavity Identification Guide.



Legend

- Project Development Area (PDA)
- Local Assessment Area
- Transmission Line
- Local Road
- Resource Road / Trail
- Railroad
- Pileated Woodpecker Observation or Evidence
- Nightjar Survey Location
- ARU Bat Monitoring
- Breeding Bird Survey Point Count Location
- Point Count Buffers (150m / 250m)
- Bat/Woodpecker Survey Transect

Species at Risk

- Canada Warbler
- Common Nighthawk
- Eastern Wood-Pewee
- Olive-sided Flycatcher

Habitat

- Hardwood
- Softwood
- Mixedwood
- Regenerating
- Anthropogenically Disturbed
- Utility Corridor
- Waterbody
- Field Delineated Wetland
- Watercourse
- Waterbody

0 100 200 300 400 500 Metres

(At original document size of 8.5x11)
1:15,000

N

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by MB on 2025-01-09
Revised by AC on 2025-03-04

Client/Project
121418141
Spence Aggregates Limited
Spence Quarry Expansion

Figure No.
5.5.1

Title
Observed Wildlife and Wildlife Habitat

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/9/2025
Esri, NASA, NGA, USGS, Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of New Brunswick, Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NRCan, Parks Canada

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5.5.1.2.2 Common Nighthawk Surveys

Common Nighthawk surveys were conducted on June 20, 2024, at two locations by a team consisting of two Stantec biologists. Survey locations were chosen in suitable habitat for Common Nighthawks, in areas that were accessible at night (Figure 5.5.1). Surveys consisted of six-minute silent listening periods, as per the Canadian Nightjar Survey Protocol (Birds Canada 2024). Surveys were conducted in recommended weather conditions with low winds and no precipitation, as per the protocol.

5.5.1.2.3 Breeding Bird Surveys

Breeding bird surveys were conducted as a series of point counts completed over two days on June 12 and 13, 2024. Forest and non-forest data from NSNRR were refined using desktop analysis to create a habitat database for the LAA, which was used when choosing point count locations. All survey locations were established within 500 m of the PDA, a minimum of 250 m from another survey point, and 100 m from the edge of another habitat type, where feasible (Figure 5.5.1). A team consisting of two Stantec biologists completed 10-minute point counts in each of the selected point count sites under recommended weather conditions with low winds and limited precipitation (CWS 2022). In total, 10 point counts were completed over the two survey days.

5.5.1.2.4 Bat Surveys

Bat Habitat Surveys

The Project is located within an area identified as having the potential to contain critical habitat for three federally protected bat species: little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and tri-coloured bat (*Perimyotis subflavus*; ECCC 2018). Critical habitat for these species is defined in the recovery strategy as locations with confirmed hibernacula of at least one of the three threatened bat species between 1995 and 2018 (ECCC 2018). Hibernacula for these species are found in subterranean features such as caves or abandoned mines with low levels of light and noise and stable temperatures (ECCC 2018).

Maternity roosts are also important bat habitat, however, due to the undocumented nature of bat maternity roosts, ECCC does not identify maternity roosts as critical habitat under the recovery strategy, at this time (ECCC 2018**).** These features are important for survival and recovery of protected species, and understanding the potential for bat maternity sites in the PDA is important for informing planned next steps. Data were collected following a method based on the Ontario Ministry of Natural Resources and Forestry (2017) Survey Protocol for Species at Risk Bats within Treed Habitat, a protocol previously used in Atlantic Canada for assessing potential bat habitat.

Stantec conducted bat habitat surveys in the spring of 2024 to assess the PDA for biophysical features that could indicate critical habitat. Field staff surveyed for bat habitat within the PDA on foot by walking standardized transects approximately 50 m apart (Figure 5.5.1).

Autonomous Recording Units

In May 2024, Stantec initiated acoustic surveys using Autonomous Recording Units (ARUs) to identify the presence of bats in and around the PDA. ARUs passively record the echolocation calls of passing bats (often referred to as “bat passes”) and the frequencies of the recorded calls, in combination with other call characteristics, to identify a species. This survey is intended to identify active bat species within the PDA and closely surrounding areas, including any likely SAR and SOCC.

The PDA was visited in spring 2024 to identify high quality bat habitat (e.g., forest corridors, forest edges, waterbodies, and/or watercourses). Sites with the highest potential to support maternity colonies were identified and detectors were placed at those sites. Field placement of the ARUs considered the degree of surrounding clutter, with ARUs placed in relatively uncluttered environments to the extent possible.

Four bat detector locations were chosen for the acoustic bat surveys to represent both foraging and maternity roost habitat, to provide adequate site coverage, and to be representative of habitat types identified in the study area. ARU deployment details are provided in Table 5.5.1.

Table 5.5.1 Bat ARU Deployment Details and Habitat Characteristics

Detector ID	Deployment Details	Habitat Characteristics
SQ-1	On a telescopic pole, 2.5 m above ground level	Mid-Successional Mixedwood
SQ-2	On a telescopic pole, 4.5 m above ground level	Mixedwood Treed Swamp
SQ-3	On a telescopic pole, 2.5 m above ground level	Mature Coniferous stand (remnant in clear cut) surrounding pond
SQ-4	On a telescopic pole, 2.5 m above ground level	Mature Mixedwood Stand

5.5.1.2.5 Other Wildlife

Incidental wildlife observations were recorded during all field surveys conducted in 2024, including during Pileated Woodpecker Habitat, Common Nighthawk, breeding bird, vegetation, and wetland surveys.

5.5.1.3 Description of Existing Conditions

5.5.1.3.1 Information from Existing Data Sources

The AC CDC report produced records of 67 observations within 5 km of the PDA since 1989, consisting of 48 bird, 1 fish, 2 herptile, 7 invertebrate, and 8 reptile species. For the purposes of this assessment, only records from the past 15 years are included below. The full AC CDC data report is included as Appendix C.

5.5.1.3.2 Pileated Woodpecker Habitat Surveys

No Pileated Woodpecker nest sites were observed during the habitat surveys. Eight observations of Pileated Woodpecker activity were made which included four observations of tree workings, two observations of birds drumming (breeding male display), 1 bird foraging, and 1 roost tree. A summary of observations is presented in Appendix D, Table D.1.

5.5.1.3.3 Common Nighthawk Surveys

Fourteen Common Nighthawk observations were made during the one-night survey at two different survey locations. Of these observations, 10 were determined to be unique individuals. At least two individuals were engaged in breeding display behaviour. An additional six Common Nighthawks were recorded as incidental observations during other field surveys, one of which was exhibiting a breeding display. Breeding displays indicate probable breeding activity of Common Nighthawk within the PDA. A summary of survey observations is presented in Appendix D, Table D.2.

5.5.1.3.4 Breeding Bird Surveys

Ten point counts conducted on June 12 and 13 resulted in observations of 115 individual birds from 31 species. Incidental observations recorded during point counts and other field surveys identified an additional seven bird species. SAR and SOCC are discussed further below. A summary of species and detailed results of the breeding bird surveys are presented in Appendix D, Table D.3.

Species richness was calculated for each of the habitat types sampled within the PDA as shown in Table 5.5.2. Species richness indicates the number of species observed in each habitat type during point count surveys. Level of effort varied between habitat types; therefore, species richness is not directly comparable between habitats.

Table 5.5.2 Habitat Types Sampled During Breeding Bird Surveys with Species Richness

Land Classification Type	% Area within LAA (ha)	% Area within PDA (ha)	Point Counts Completed in each Habitat	Species Richness (Number of Species)
Anthropogenic	7.5	30.2	1	12
Hardwood	16.6	6	1	8
Mixedwood	52.9	18.7	4	21
Softwood	16.1	0.2	1	10
Regenerating	6.8	41.1	1	8
Wetland	0.1	3.9	2	24

5.5.1.3.5 Bat Surveys

Bat Habitat Surveys

Bat habitat surveys were completed on April 10 and 11, 2024, by a team of two Stantec biologists. No subterranean features for potential hibernacula sites such as caves or old mine workings were found within the PDA or LAA, and no visible signs of geology suggesting potential for hibernacula (e.g., karst topography) were observed. Based on these observations, it is unlikely that there are hibernacula sites within and around the PDA.

While assessing for hibernacula, Stantec identified and assessed forested stands within the LAA for maternity roosting potential. A total of 17 stands were identified by field staff as having the potential to support maternity roosts. Within these potential stands, field staff assessed and recorded the composition and approximate age of the stands, along with the presence of Usnea lichens, snags, and state of decay. Stantec also noted large trees with cavities, cracks, and crevice’s as well as loose peeling bark. Full results of bat habitat surveys are presented in Appendix E, Table E.1.

Based on the results of these surveys, there is reasonable potential for maternity roosts within the LAA, considering the suitable treed habitat and given the proximity to known hibernacula sites indicated by the area’s identification as potential critical habitat (ECCC 2018).

Autonomous Recording Units

Deployment of the four ARUs occurred on May 29, 2024. Batteries were checked on June 21, and ARUs were retrieved on July 22, 2024. The number of recording nights for each ARU was 54.

Acoustic data were analysed using Wildlife Acoustics' Kaleidoscope Pro software, as per the guidance specified in the *Guide for Bat Monitoring in Atlantic Canada* (McBurney and Segers 2021). The data processing though Kaleidoscope Pro involves running the software’s automatic identification, which screens out noise files (that were not previously screened out by the detector) and provides a suggested species for each bat call file. In some cases, species cannot reliably be identified to species. These calls are categorized as No ID by the software.

Calls were manually reviewed by a qualified biologist to confirm the identification. Where a call was reviewed and determine to be in the *Myotis* genus, but a species ID was not possible, it was categorized as Myotis species (40KMyo). In other instances, if a call was manually reviewed and of a high frequency (>35khz), and thus potentially representative of a SAR bat, it was categorized as ‘high-frequency unknown.’ Alternatively, low frequency calls (<35khz) that could not be identified to species were categorized as ‘low-frequency unknown.’ These calls could represent hoary, silver-haired bat (*Lasionycteris noctivagans*), or big brown bat (*Eptesicus fuscus*). Additional similar species groupings include big brown bat/silver-haired bat and eastern red bat (*Lasiurus borealis*)/tri-colored bat. No identification (NoID) was used when a call meets the criteria of a bat pass but lacks the characteristics for species or batch identification.

Five species of bats were identified from the acoustic results, including little brown myotis, eastern red bat, silver-haired bat, hoary bat (*Lasiurus cinereus*), and tri-colored bat. Little brown myotis was the most commonly identified species, with 0.40 calls per detector night. Eastern red bat, silver-haired bat, hoary bat, and tri-colored bat were all recorded at similar frequencies with 0.08, 0.06, 0.05, and 0.04 calls per detector night respectively.

Many bat recordings could not be identified to species and were put into categories including Myotis species, eastern red/tri-colored bat, high frequency unknown, low frequency unknown, and no identification. Most standardized recorded calls (59% or 1.41 calls/detector night) were categorized as Myotis species. This category includes little brown myotis and northern myotis (*Myotis septentrionalis)*. The next largest category of bats was high frequency unknown (11% or 0.27 calls/detector night). This category includes the two myotis species, as well as tri-colored bat and eastern red bat.

Most of all bat calls were recorded at ARU location SQ_3, which recorded 246 (48%) total calls. The other ARUs recorded a similar number of calls to each other (SQ_1, 97; SQ_4, 96; SQ_2, 76).

Temporal activity patterns are found in Table 5.5.3.

Table 5.5.3 Summary of Acoustic Bat Surveys

Species or Group	Number of Bat Passes per Detection Night		
	May	June	July
Myotis species	1.13	1.15	1.76
Unknown high frequency	0.13	0.21	0.37
Eastern red bat	0.06	0.05	0.13
Hoary bat	0.00	0.01	0.12
Silver-haired bat	0.00	0.02	0.13
Unknown low frequency	0.00	0.02	0.04
Little brown myotis	0.56	0.25	0.56
Eastern red bat or tri-colored bat	0.00	0.00	0.10
Tri-colored bat	0.00	0.02	0.08
NoID (unknown bat)	0.00	0.00	0.04

5.5.1.3.6 Species at Risk and Species of Conservation Concern

Field surveys within the LAA identified five SAR (three birds, two bats) and six SOCC (three birds, three bats). AC CDC records from the past 15 years identified an additional five SAR (three birds, one reptile, and one invertebrate) and one SOCC (a bird) with potential of occurring within the LAA at some time in the year. These records do not include fish (see section 5.3). SAR and SOCC and their conservation rankings are presented below in Table 5.5.4. SAR are discussed in detail below.

Table 5.5.4 Wildlife SAR and SOCC Observed or Reported Within or Near the LAA (since 2004)

Common Name	*Scientific Name*	SARA	COSEWIC	NS ESA	S Rank	Data Source
Birds						
American Kestrel	*Falco sparverius*	-	-	-	S3B, S4S5M	Stantec
American Robin	*Turdus migratorius*	-	-	-	S5B,S3N	Stantec
*Bank Swallow	*Riparia riparia*	TH	SC	EN	S3B	AC CDC
*Bobolink	*Dolichonyx oryzivorus*	TH	SC	VU	S3B	AC CDC
*Canada Warbler	*Cardellina canadensis*	TH	SC	EN	S3B	Stantec, AC CDC
*Common Nighthawk	*Chordeiles minor*	SC	SC	TH	S3B	Stantec, AC CDC
Eastern Kingbird	*Tyrannus tyrannus*	-	-	-	S3B	AC CDC
*Eastern Wood-Pewee	*Contopus virens*	SC	SC	VU	S3S4B	Stantec, AC CDC
Killdeer	*Charadrius vociferus*	-	-	-	S3B	Stantec, AC CDC
Least Sandpiper	*Calidris minutilla*	-	-	-	S1B,S4M	Stantec
*Olive-sided Flycatcher	*Contopus cooperi*	SC	SC	TH	S3B	AC CDC
Bats						
Eastern red bat	*Lasiurus borealis*	-	EN	-	SUB,S1M	Stantec
Hoary bat	*Lasiurus cinereus*	-	EN	-	SUB, S1M	Stantec
*Little brown myotis	*Myotis lucifugus*	EN	EN	EN	SUB,S1M	Stantec
Silver-haired bat	*Lasionycteris noctivagans*	-	EN	-	SUB,S1M	Stantec
*Tri-colored bat	*Perimyotis subflavus*	EN	EN	EN	S1	Stantec
Other Wildlife						
*Eastern painted turtle	*Chrysemys picta picta*	SC	SC	-	S4	AC CDC
*Monarch	*Danaus plexippus*	EN	EN	EN	S2?B,S3M	AC CDC

Notes:
Asterisks(*) indicate SAR
SAR/COSEWIC/NS ESA codes used:
SC = Special Concern; TH = Threatened; VU = Vulnerable; EN = Endangered; NAR = Not at Risk
S-Rank definitions (AC CDC 2024):
S1 = Critically Imperiled: Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 = Imperiled: Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 = Vulnerable: Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 = Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 = Secure: Common, widespread, and abundant in the province.
SNR = Unranked: Nation or state/province conservation status not yet assessed.
SNA = A conservation status rank is not applicable because the species is not a suitable target for conservation activities
SU = Unrankable: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
B = Breeding population
M = Migratory Population

Bank Swallow

The Bank Swallow (*Riparia riparia*) is listed as threatened on Schedule 1 of SARA and by COSEWIC, and as endangered by the NS ESA. This species is a small insectivorous songbird that has an extensive distribution. It breeds in a wide variety of natural and artificial sites with vertical banks, including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stockpiles of soil. Sand-silt substrates are preferred for excavating nest burrows. Critical habitat (habitat that is necessary for the survival or recovery of a species) has been defined and mapped for Bank Swallow in Nova Scotia (NSNRR 2021) as suitable nesting habitat and surrounding foraging habitat, within 500 m of the nesting area. Foraging habitat consists of open habitats that produce insects such as wetlands, salt marshes, grasslands and hay fields. Seasonal wetlands or ponds that are flooded are important sources of insect prey for Bank Swallows. A federal recovery strategy was released in 2022 in which human-made nesting habitats such as sandpits and quarries are not identified as critical habitat (ECCC 2022a).

The PDA does not fall within Bank Swallow critical habitat that is currently mapped. The AC CDC data search (2024) indicated that there are two records of Bank Swallow observed in 2019 within 5 km of the PDA, outside the LAA. No Bank Swallows were observed during field surveys. Although potentially suitable nesting habitat (sand piles and steep embankments) exists within the PDA, it is unlikely that Bank Swallows nest at this site. Areas of suitable habitat were investigated in 2024, and no evidence of nesting was observed, nor were any Bank Swallows observed in the PDA during the breeding season.

Bobolink

The Bobolink (*Dolichonyx oryzivorus*) is listed as threatened on Schedule 1 of SARA, as special concern by COSEWIC, and as vulnerable by the NS ESA. This species is a medium-sized passerine bird whose breeding range in Canada includes the southern part of all provinces from British Columbia to Newfoundland and Labrador. Since the conversion of prairies to croplands and the clearing of eastern forests, the Bobolink can be found nesting in forage crops (e.g., hayfields and pastures dominated by a variety of species including clover, timothy, Kentucky bluegrass, and broadleaved plants) as well as various grassland habitats, including wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie, no-till cropland, small-grain fields, restored surface mining sites, and irrigated fields in arid regions (COSEWIC 2022). A recovery strategy was proposed in 2022 (ECCC 2022b). No Bobolink were observed during field surveys, and no suitable breeding habitat was encountered in the PDA. Two Bobolink records were found by the AC CDC report (AC CDC 2024) within 5 km of the PDA, outside of the LAA, occurring in 2010 and 2019.

Canada Warbler

The Canada Warbler (*Cardellina canadensis*) is a SAR, listed as Special Concern by COSEWIC, Threatened under the federal SARA, and Endangered under the NS ESA. The AC CDC ranks the species as S3B, which indicates that breeding populations of this species are vulnerable in Nova Scotia. The SARA Recovery Strategy for Canada Warbler ranks habitat loss or degradation and accidental mortality at the “High” level of concern. In the breeding range this includes removal of shrub layer and land conversion for habitat loss and degradation, and collisions with anthropogenic structures and vehicles for accidental mortality (Environment Canada, 2016a).

The Canada Warbler is a small, neotropical migrant songbird that breeds in moist, mixedwood forests with a well-developed understory and ground layer of moss and ferns (Reitsma et al., 2020). One Canada Warbler was observed in WL2 (Figure 5.5.1), just outside the PDA but within the LAA, during field surveys, with possible breeding evidence. Further wetlands exist within the PDA and are anticipated to exist in the LAA, and could provide suitable Canada Warbler breeding habitat.

Common Nighthawk

The Common Nighthawk (*Chordeiles minor*) is a SAR, listed as Special Concern by COSEWIC and the SARA, and Threatened under the NS ESA. The AC CDC ranks the species as S3B, which indicates that breeding populations are vulnerable in Nova Scotia. The SARA Recovery Strategy for Common Nighthawk ranks changes in ecological dynamics or natural processes such as insect-breeding temporal mismatch, loss of insect-producing habitats, habitat acidification, pesticides, light pollution, and increased extreme weather events resulting in reduced availability of insect prey as a “High” level of concern (Environment Canada, 2016b).

The Common Nighthawk is an aerial insectivorous nightjar which breeds throughout much of North and Central America and winters in South America. Nesting habitat in the breeding range includes open areas such as logged or open forest clearings, rocky outcrops, and even gravel rooftops. The species typically forages for insect prey under low light conditions, most commonly at dawn and dusk (Brigham et al., 2020).

During the field surveys, there were 20 records of Common Nighthawks calling and engaging in mating displays in suitable breeding habitat in the PDA and LAA, indicating probable breeding. It is likely that the number of Common Nighthawks using the area is lower than 20 since this species is easily detected while foraging or displaying and they forage over relatively large areas; therefore, multiple sightings of a smaller number of birds can be expected At minimum, six individual Common Nighthawks were observed at one of the Common Nighthawk survey points, and four at another location. Figure 5.5.1 shows identifiable locations of Common Nighthawk, as well as the nightjar survey locations, from which the exact location of individuals was not possible to discern. Given the large areas over which Common Nighthawks forage and display, it was not possible to isolate areas where nests were present. Given the nesting habitat preferences of this species, it is possible to identify areas in the study area where nesting could potentially occur. These include disturbed areas such as the quarry and dirt road edges, the abandoned quarry at the northern end of the PDA as well as the areas of recent clearcut in the north and west of the PDA.

Eastern Wood-Pewee

Eastern Wood-Pewee (*Contopus virens*) is listed as special concern by COSEWIC, under Schedule 1 of the SARA, and Vulnerable by the NS ESA. The provincial AC CDC ranking for the Eastern Wood-Pewee is S3S4B, indicating that there is some uncertainty regarding the general status rank of the breeding population this species in Nova Scotia, ranging from vulnerable to apparently secure.

During the breeding period, the Eastern Wood-Pewee is generally associated with the mid-canopy layer within forest clearings and edges of hardwood and mixed forest stands (COSEWIC 2012b). In migration periods this species utilizes a variety of habitats including edges and clearings (COSEWIC 2012b).

Six observations of Eastern Wood-Pewee were made during field surveys (Figure 5.5.1). The species was observed singing during breeding bird surveys, indicating possible breeding. Eight records from the AC CDC over the past 15 years also exist within 5 km of the PDA. Suitable breeding habitat for Eastern Wood-Pewee, which includes mature deciduous and mixedwood forest stands that border open areas, is found within the PDA and LAA. This habitat can be found along the edge of the road and quarry, woods along the transmission line, and along the older clearcut edge.

Olive-sided Flycatcher

The Olive-sided Flycatcher (*Contopus cooperi*) is a SAR, listed as Special Concern by COSEWIC and the SARA, and Threatened under the NS ESA. The AC CDC ranks the species as S3B, which indicates that breeding populations are vulnerable in Nova Scotia. Threats faced by the Olive-sided Flycatcher include loss of wintering habitat, reductions in the abundance and availability of insect prey, and altered fire regimes and changing climates that may adversely affect nesting habitat quality (COSEWIC, 2018b.)

The Olive-sided Flycatcher is a medium-sized flycatcher which belongs to the guild of birds known as aerial insectivores which forage for insects while in flight. In Atlantic Canada, breeding habitat consists of forest openings and edges with the presence of snags for foraging and singing perches (Altman and Sallabanks, 2020).

No Olive-sided Flycatchers were recorded during field surveys. Four records of Olive-sided Flycatcher within 5 km of the PDA were present in the AC CDC data report (2024) from the past 15 years. Suitable habitat for Olive-sided Flycatcher was observed in the western area of the LAA, where there is a recent clearcut with good regenerating understory and dead snags.

Little Brown Myotis

The little brown myotis (*Myotis lucifugus*) is a small, insectivorous bat species. The species is listed as Endangered by the SARA, COSEWIC, and under the NS ESA. AC CDC lists this species as S1 meaning that the Nova Scotia population is critically imperiled. Populations of this species have been severely reduced by white-nose syndrome, an introduced disease caused by the fungus (*Pseudogymnoascus destructans*) that affects hibernating bats (COSEWIC, 2013). Habitat for the little brown myotis consists of hibernacula for overwinter survival and summering areas with suitable foraging areas within commuting range to structures used for roosting or maternity colonies. The species hibernates in caves or abandoned mines. Foraging habitat includes lakes, ponds and rivers, forest gaps, the edges of forests and along trails (Environment Canada 2018). This bat species tends to avoid large open areas such as agricultural land, large clear-cuts and burned forests. Little brown myotis females will establish maternity colonies in buildings, under bridges, in rock crevices, or in cavities of canopy trees in forests.

Little brown myotis was recorded on the bat ARU surveys within the PDA and LAA. Bat habitat surveys did not reveal any subterranean features that could serve as potential hibernacula, and no visible signs of geology suggesting potential for hibernacula were observed. However, field surveys of forested stands within the LAA revealed 17 stands with potential to support maternity roosts (Appendix E, Table E.1). These include the forested stand on the eastern side of the PDA which contained trees with cavities and peeling bark for maternity roosts. Mature forest stands in the southwest of the LAA which contained large trees such as poplars (*Populus* spp.) and snags could provide cavities suitable for maternity colony sites.

Tri-colored Bat

The tri-colored bat is a small, insectivorous bat species. The species is listed as Endangered by the SARA, COSEWIC, and under the NS ESA. AC CDC lists this species as S1 meaning it is critically imperiled. Populations of this species have been severely reduced by white-nose syndrome, an introduced disease caused by the fungus (*Pseudogymnoascus destructans*) that affects hibernating bats (COSEWIC, 2013). Habitat for the tri-colored bat consists of hibernacula for overwinter survival and summering areas with suitable foraging areas within commuting range to structures used for roosting or maternity colonies. This species hibernates in caves or abandoned mines. Foraging habitat includes lakes, ponds and rivers, forest gaps, the edges of forests and along trails (Environment Canada 2018). Tri-colored bats tend to avoid large open areas such as agricultural land, large clear-cuts and burned forests. Tri-colored bats often establish maternity roosts in clumps of arboreal lichens (*Usnea trichodea*) which typically grow on conifer trees (Poissant et al. 2010).

Tri-colored bat was recorded on the bat ARU surveys within the PDA and LAA. Bat habitat surveys did not reveal any subterranean features that could serve as potential hibernacula, and no visible signs of geology suggesting potential for hibernacula were observed. However, field surveys of forested stands within the LAA revealed 17 stands with potential to support maternity roosts (Appendix E; Table E.1). These include the forested stand on the eastern side of the PDA which contained trees with suitable *Usnea* lichen and peeling bark for maternity roosts. Large mature stands in the LAA to the west of the PDA which contain large trees and snags could also potentially provide suitable maternity colony habitat.

Eastern Painted Turtle

The eastern painted turtle (*Chrysemys picta picta*) is a SAR, listed as special concern under SARA and COSEWIC. The AC CDC ranks the species as S4, indicating that the species is apparently secure in Nova Scotia. The eastern painted turtle is a subspecies of the painted turtle (*C. picta*) which is a small to medium sized freshwater turtle. The eastern subspecies is found in Nova Scotia, New Brunswick, and Quebec, and plays important ecological roles in aquatic ecosystems such as nutrient cycling and seed dispersal. They are found in shallow and slow-moving wetlands and waterbodies, and are semi-tolerant of human-altered landscapes. Threats to the Eastern Painted Turtle include road mortality, habitat degradation and loss, invasive species, and subsidized predators (COSEWIC 2018a).

No eastern painted turtles were observed during field surveys. There is one AC CDC record of this species within approximately 3 km of the PDA. There does not appear to be eastern painted turtle foraging habitat in the PDA, but suitable habitat may exist nearby at small ponds and lakes, such as the pond off Ball Park Road, where the AC CDC record was observed. There is potential for road banks and embankments, and open disturbed areas associated with past and ongoing quarrying operations in the PDA to be used as nesting habitat by eastern painted turtle.

Monarch

The monarch (*Danaus plexippus*) is a large, showy butterfly, and one of the most well-studied in the world. This species is listed as Endangered by SARA, COSEWIC, and under the NS ESA. AC CDC lists this species as S2?B,S3M, indicating the species is considered imperiled in Nova Scotia although there is some uncertainty associated with the general status rank. Monarch adults migrate into Nova Scotia in summer and seek out milkweed plants on which to deposit their eggs. The larvae feed exclusively on milkweed (COSEWIC 2016) which in Nova Scotia is represented by two species, common milkweed (*Asclepias syriaca*) and swamp milkweed (*Asclepias incarnata*), Common milkweed is an introduced species that is typically found on disturbed sandy sites such as roadsides, disturbed areas and agricultural fields. Swamp milkweed is found in forested wetlands and along the margins of lakes and ponds. Neither of these species is common in Nova Scotia which limits the distribution of suitable monarch breeding habitat in the province). There is a Management Plan (ECCC 2016b) in place for monarch, however there is no Critical Habitat identified at this time.

Four monarch observations were recorded within 5 km of the PDA by the AC CDC report. No milkweed was recorded in the PDA during the course of field surveys, so it is unlikely that monarchs breed at the site. However, monarchs may forage in the PDA during migration.

5.5.1.3.7 Incidental Wildlife Observations

A variety of wildlife were observed during avian and other field surveys conducted in the summer of 2024. The following mammal species were either observed directly, or indirectly (e.g. scat, footprints):

- American black bear (*Ursus americanus*)
- coyote (*Canis latrans*)
- Eastern chipmunk (*Tamias striatus*)
- snowshoe hare (*Lepus americanus*)
- white-tailed deer (*Odocoileus virginianus*)

None of these species are identified SAR or SOCC and all have an AC CDC S-Rank of SNA or S5, indicating they are common, widespread, and abundant in the province and/or not a suitable target for conservation activities. Observations are presented in Appendix D, Table D.4

5.5.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Wildlife and Wildlife Habitat is provided in Table 5.5.5. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.5.5 Potential Effects, Effect Pathways and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Habitat Availability	Project activities could affect habitat availability through vegetation clearing and sensory disturbance.	Area (ha) of land cover classes and potential habitat directly disturbed by the Project, including any defined critical or core habitat for SAR. Habitat loss due to reduced habitat effectiveness (e.g., sensory disturbance) will be addressed qualitatively.
Direct Mortality Risk	Project activities could affect direct mortality through clearing and contact with vehicles.	Change in direct mortality risk (e.g., through destruction of active nest, den or vehicle/wildlife collisions) to be assessed qualitatively.
Indirect Mortality Risk	Project activities could result in indirect mortality risk through increased predation along newly created edges, noise, light, ground vibrations, and increased human activity.	Changes in indirect mortality risk (e.g., increased human access, predation rates due to edge effects) to be assessed qualitatively.

Both direct and indirect environmental effects on wildlife and their habitats are expected through the life of the Project. Direct effects, including direct mortality and habitat loss, are expected to be greatest during site preparation. Indirect effects, including noise, light, and ground vibrations, are expected to be greatest during quarry operations, particularly during active blasting activities. An existing mitigating factor to these potential effects is the presence of suitable habitat in surrounding areas that is similar to habitat within the PDA that will be lost.

The Project will lead to a direct loss of vegetation communities and associated terrestrial habitat due to site preparation activities, including vegetation clearing and grubbing. Fragmentation of natural habitats in the PDA may impede movement for small mammals due to the lack of cover and increased predation, and some small mammals may experience direct mortality because of clearing, or increased vehicle traffic. Forest interior birds may become vulnerable to the negative impacts of direct habitat loss and adverse edge effects but will likely compensate by relocating to adjacent/nearby suitable habitat. Indirect effects, such as noise, visual, olfactory, and other sensory stimuli (e.g., dust, vibration) emitted from the operation of Project vehicles, equipment, site lighting, personnel, and activities (e.g., blasting) could potentially impact wildlife behavior. However, since the operation of the quarry has been ongoing at the existing site for many years, the Project does not introduce an additional source of disturbance and past and ongoing operations at the quarry have either discouraged animals from residing in the existing quarry site or have resulted in the habituation of these species to the activities that occur on site.

5.5.3 Mitigation and Management Measures

The following mitigation measures specific to Wildlife and Wildlife Habitat have been identified for the Project:

- Project related clearing and grubbing activities will be scheduled, when feasible, outside the bird breeding season to prevent inadvertent harm to most bird species and to comply with both the MBCA and provincial *Wildlife Act.* Similarly, scheduling of clearing and grubbing activities outside of the pupping season for bats will reduce the potential for harm to SAR and SOCC bat species.
- If scheduling of clearing and grubbing outside the bird breeding season is not feasible, Spence Aggregates Limited will assess established mitigation measures under the MBCA. If full avoidance during the timeframes is not practical, qualified biologists will conduct thorough searches, and avoidance setbacks will be established around active nests as a minimum precaution.
- If scheduling of clearing and grubbing outside the pupping season for bats is not feasible, areas suitable for bat maternity colonies will be identified and demarcated. No clearing will be permitted in these areas until ARUs are deployed and it is demonstrated that no bats are using the potential maternity colony habitat or until the pupping season has ended.
- Domestic waste will be stored in secure receptacles to prevent attracting birds and other wildlife to the PDA
- Project vehicles will adhere to posted speed limits on both the access road and internal site roads, aligning with provincial regulation and industry standards
- Staff will report wildlife incidents to their supervisor, which will be reported to NS DNR and/or CWS, when appropriate
- Personnel will not feed, harass, or hunt wildlife while working on the Project

5.5.4 Residual Environmental Effects

A significant adverse residual effect on Wildlife and Wildlife Habitat is one that, following the application of avoidance and mitigation measures, causes or further contributes to the exceedance of a conservation-based threshold or threatens the long-term persistence or viability of species of management concern, or species of cultural or traditional importance.

5.5.4.1 Change in Habitat Availability

Residual effects related to habitat loss and fragmentation will occur within the PDA. Indirect effects on habitat availability (e.g., related to sensory disturbance) may extend beyond the PDA into the LAA. The Project is expected to result in the incremental direct alteration or loss of approximately 63 ha of vegetation communities and associated terrestrial wildlife habitat. Most of this habitat consists of young regenerating forest although some mature forest is present along the eastern edge of the existing quarry. The PDA is partially fragmented by woods roads and old quarries.

The surrounding area is also largely forested with most of the area adjacent to the PDA composed of young regenerating forest. Beyond these regenerating forests are large areas of relatively mature forest. The surrounding area is also partially fragmented by woods roads and a suburban area is located just outside of the PDA to the north. It is therefore unlikely that the incremental increase in alteration or loss of habitat caused by the quarry expansion will have irreversible adverse effects on wildlife populations including wildlife SAR or SOCC in the area. The operation of the existing quarry also makes it unlikely that wildlife species intolerant of human activity currently inhabit the Project Area, and likely that animals present in the LAA have habituated to the sensory disturbance. Therefore, avoidance behavior and associated wildlife displacement effects are expected to be limited and highly localized. The expanded quarry footprint's terrestrial habitat will undergo progressive restoration activities such as grading, contouring, capping of soil, and revegetation. Although approximately 63 ha of existing wildlife habitat will be directly impacted, it is expected that suitable habitat for wildlife, including SAR and SOCC, can be eventually restored though reclamation efforts. The predicted residual habitat loss and fragmentation effects are considered reversible upon Project completion.

5.5.4.2 Change in Mortality Risk

The residual change in mortality risk for avifauna and bats will be greatest during sensitive time periods such as the bird breeding period or the pupping season for bats. Risk will be reduced through the application of timing windows for site preparation activities that involve the removal of vegetation (e.g., clearing and grubbing). If vegetation removal cannot otherwise be avoided during the primary nesting period, avian use and nest search surveys will be completed prior to the initiation of Project activities to mitigate the risk to avifauna by identifying and avoiding active nests. Pileated Woodpecker (*Drycopus pileatus*) habitat surveys will also need to be repeated prior to any clearing during the primary nesting period, as surveys completed in 2024 may not adequately reflect Pileated Woodpecker presence in subsequent years. Surveys to determine if suitable bat maternity colony habitat is present and ARU surveys to determine if they are active would also be required if temporal avoidance is not possible.

Blasting is unlikely to pose a substantial risk of injury or mortality to wildlife since it is anticipated that most wildlife species would avoid areas where blasting may occur, as there would be noticeable activity in the area prior to the blast.

5.5.4.3 Summary

Project-related residual effects on wildlife and wildlife habitat are generally predicted to be continuous in frequency (although residual injury and mortality effects are not anticipated to occur frequently), medium-term in duration (i.e., the residual effects are predicted to extend throughout the life of the Project), and reversable following reclamation. The predicted magnitude of Project related residual adverse effects on wildlife and wildlife habitat is characterized as "moderate" (i.e., measurable changes from existing/baseline conditions that may exceed natural variability but do not exceed guidelines, standards, or regulatory limits, nor do they pose a risk to the long-term viability of SAR or SOCC in the surrounding area).

Based on the above and considering the area of the Project, the availability of surrounding habitats like those within the LAA, and assuming application of the recommended mitigation measures described above, Project-related residual effects on wildlife and wildlife habitat, including SAR and SOCC, are predicted to be not significant.

5.5.5 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for wildlife and wildlife habitat. Additional surveys will be completed should clearing and grubbing not be feasible outside the breeding bird and /or bat pupping seasons.

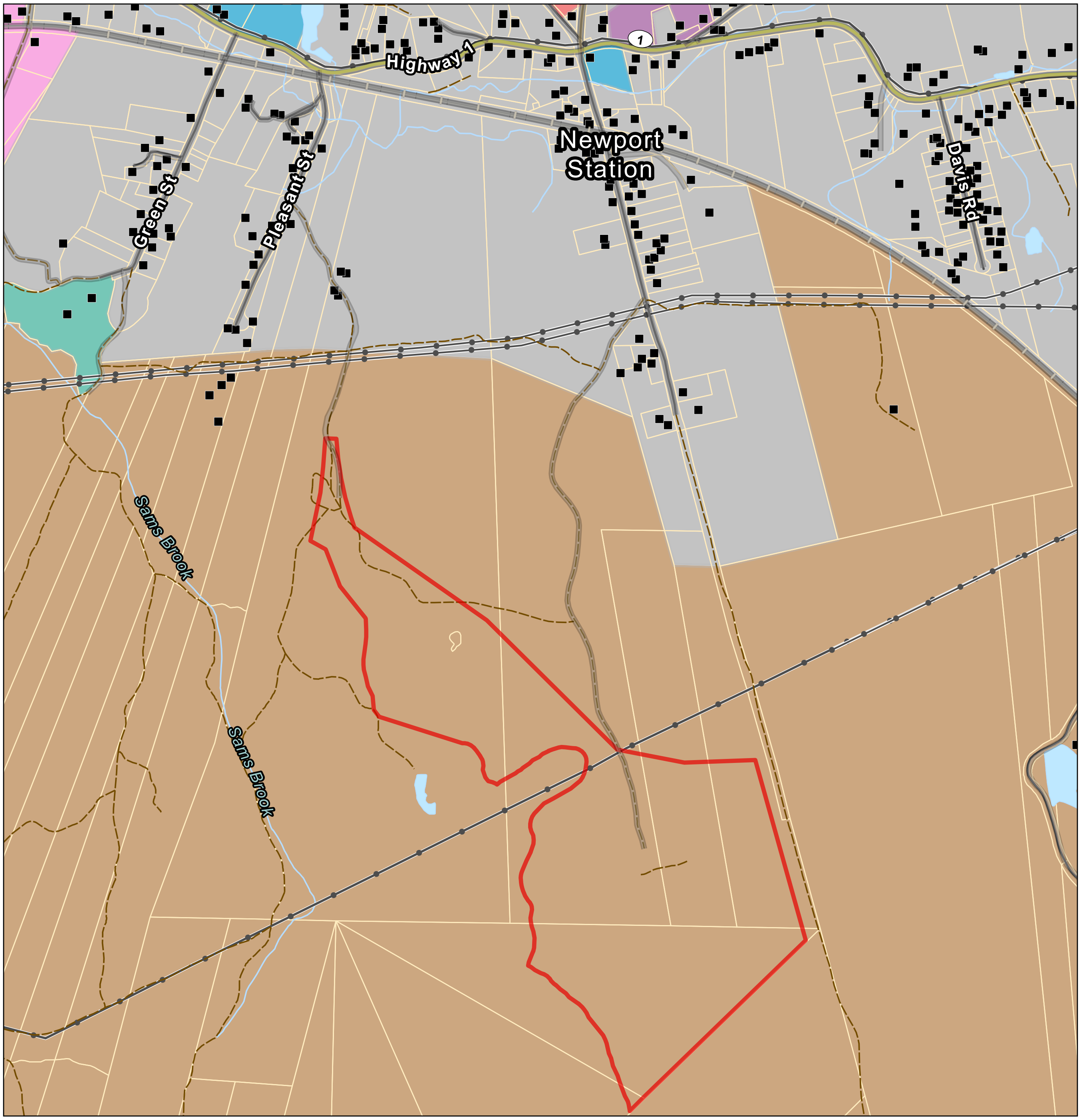
5.6 Land Use

The Land Use VC includes a baseline description of the current land use in the PDA, including any designations afforded to the land that would restrict or inhibit the Project from proceeding as well as lands within 1-2 km of the PDA.

This VC does not include an in depth assessment of topics considered in other VCs including noise (section 5.1), vegetation and/or wetlands (section 5.4) or wildlife and/or wildlife habitat (section 5.5), however, where these topics potentially affect peoples' use of lands, they are considered.

5.6.1 Existing Conditions

The existing quarry and the PDA are located on land zoned for general resource uses including extractive facilities (MWH 2008). The zoning of lands (Figure 5.6.1) included within the PDA is General Resource (MWH 2008). Lands surrounding the Project are predominantly also General Resource, with some Rural Residential zoning to the north. Much of the land surrounding the Project is also owned by Spence Aggregates and is undeveloped. A transmission line runs through the PDA just north of the existing quarry. Newport Station, Nova Scotia is located just to the north of the Project and is largely zoned residential.



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, OSM, Stantec
3. Background: Google (n.d.) [Satellite Map Newport Station, NS]. Retrieved 4/4/2025
Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of New Brunswick, Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NRCan, Parks Canada

Legend
- Project Development Area (PDA)
- Property Parcel

Zoning
- Hamlet Industrial
- Rural Commercial
- Open Space
- Agriculture
- General Resource
- Two Unit Residential
- Rural Residential

- Building
- Arterial
- Local Road
- Resource Road / Trail
- Railroad
- Transmission Line
- Waterbody
- Watercourse

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Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by AC on 2025-03-05

Client/Project
Spence Aggregates Limited
Spence Quarry
Expansion

121418141

Figure No.
5.6.1

Title
Land Use

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There is limited recreational use in the PDA and on surrounding lands. The lands are privately owned, largely by Spence Aggregates, and may be used for hunting and other activities. Signs are posted indicating private land ownership and prohibiting trespassing, which is expected to limit unauthorized use of the land by others. There is a transmission line that runs through the PDA which could provide access, however, use of this transmission is discouraged by Nova Scotia Power. Resource roads are also present in and around the PDA but access is limited by gates around the existing quarry, and signage as described. Spence Aggregates is not aware of any unauthorized land use in the PDA.

There are no provincial parks or known sensitive heritage or cultural attractions near the PDA nor are there any designated public recreational trails or public recreational lands present in the vicinity of the PDA. A portion of the St. Croix River Conservation Lands is located approximately 3.5 km northeast of the Project (GNS 2023); this represents the closest protected land and is not anticipated to be affected by the Project.

The *Pit and Quarry Guidelines* (NSEL 1999) require a minimum setback of 800 m from the foundation or base of a structure located off-site. As described in the *Pit and Quarry Guidelines*, the definition of a "structure" includes residential buildings, schools, churches, commercial buildings, municipal or provincial facilities, hospitals, or other industrial buildings. The distance is measured from the working face and point of blast to the foundation or base of the structure, and can be reduced with written consent from all individuals owning structures within 800 m.

The lands surrounding the PDA are largely undeveloped, however, to the north and northwest, there are a few houses located on Stark Road, and Pleasant Street. Several of these residential structures are located within 800 m of the PDA and may be located within the 800 m setback; however, the maximum extent of the working face of the expanded pit is not known exactly at this time. Two additional structures are located east of the PDA and are associated with the St. Croix Observatory, and the Salmon Hold Dam. These structures may also fall within the 800 m setback. Prior to the working face coming within 800 m of any structure, written consent from the owner will be obtained, as described in the *Pit and Quarry Guidelines*.

5.6.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Land Use is provided in Table 5.6.1. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.6.1 Potential Effects, Effect Pathways and Measurable Parameters for Land Use

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Direct Effects on Land Use in the PDA	• Operations could require zoning changes • Recreation could be restricted in the PDA	• Required alterations to current zoning • Changes to public recreation in the PDA
Indirect Effects on Land Use in the Broader Area	Operations could affect residential areas near the project through changes to noise, air quality, and aesthetics Operations could affect recreation on surrounding lands	• Increased noise and/or emissions at residential receptors or and increased number of receptors from which operations are visible • Recreation occurrences on surrounding lands

Direct effects on land use are not anticipated as a result of the Project. The Project is located on lands already zoned for the proposed use. The Project is not anticipated to increase the quarry output; thus zoning alterations are not anticipated. As there is no known public recreation in the PDA, it is not anticipated that the Project will affect recreational use of lands within the PDA.

Indirect effects are possible as the Project expansion will increase the overall size of the quarry. Potential indirect effects include increases in noise and air quality emissions, the alteration of visual fields from receptors, and impacts on the recreation on surrounding lands. Noise and air quality are expected to be limited, given the lack of an increase in quarry production, but are discussed in detail in section 5.1. Unwanted changes to the aesthetics of the area are anticipated to be limited due to the forested habitats in the area, and the required setbacks from structures including homes. Changes to recreation on surrounding lands may occur but should be limited as Spence Aggregates owns much of the surrounding lands. Indirect effects on wildlife may also affect the value of surrounding lands for recreation. These potential effects are detailed in section 5.5.

5.6.3 Mitigation and Management Measures

No specific mitigation or management measures are identified for the Land Use VC that are not already in place through the existing IA. Spence Aggregates will continue to actively discourage unauthorized use of the PDA lands through signage and road controls and will continue to abide by the *Pit and Quarry Guidelines* requiring written permission for operations within 800 m of structures. Spence Aggregates will also continue to have blasts monitored by qualified professionals. Mitigation pertaining to potential effects to the broader environment (e.g., noise, air quality, wildlife) are discussed in the applicable VCs.

5.6.4 Residual Environmental Effects

A significant adverse residual environmental effect is one where the proposed use of land for the Project is not compatible with adjacent or historical land use activities as designated through a regulatory land use process, and/or the proposed use of the land will create a change or disruption that widely restricts or degrades present land uses to a point where the activities cannot continue at current levels and for which the environmental effects are not mitigated or compensated.

Lands included in the PDA are appropriately zoned and are already owned by the Proponent. Lands are not used for known recreation and impacts on the broader landscape is expected to be limited. Residual effects on land use are predicted to be not significant.

5.6.5 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for the Land Use VC. Monitoring pertaining to potential effects to the broader environment (e.g., noise, air quality) potentially affecting land use and enjoyment are discussed in the applicable VCs.

5.7 Heritage Resources

Heritage Resources is a VC in recognition of their importance to the Mi'kmaq, the public, and regulatory agencies responsible for the management of such resources. Heritage resources include historical, archaeological, architectural (built heritage) and palaeontological (fossil) resources. For the purposes of this EARD, heritage resources are non-renewable resources consisting of places, buildings, objects, or sediment deposits located above or below the ground that inform us of the past activities of people and their interactions with the environment. Every heritage resource is unique, and its significance lies in the story it tells and how this story contributes to human history by broadening our understanding of our shared human past. As non-renewable resources, damage to or loss of heritage resources would mean a permanent loss of the resources and the wider contextual information they may have provided. Heritage resources are relatively permanent, although highly tenuous, features of the environment and can include Pre-Contact or Historic Period archaeological sites and objects of significance for Mi'kmaq and historic peoples who have emigrated to this area, built heritage resources, and naturally occurring palaeontological resources (i.e., fossils).

In Nova Scotia, heritage resources are regulated under the *Special Places Protection Act* (2010), the *Heritage Property Act* (2010), and the *Cemeteries and Monuments Protection Act* (2011). The regulatory management of heritage resources is the mandate of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage (NSCCTH) which is administered and regulated by its Special Places division.

This section will assess potential environmental effects of the Project on archaeological, built heritage, and palaeontological resources. All "historical" resources are understood to be captured under one of these heritage resource types.

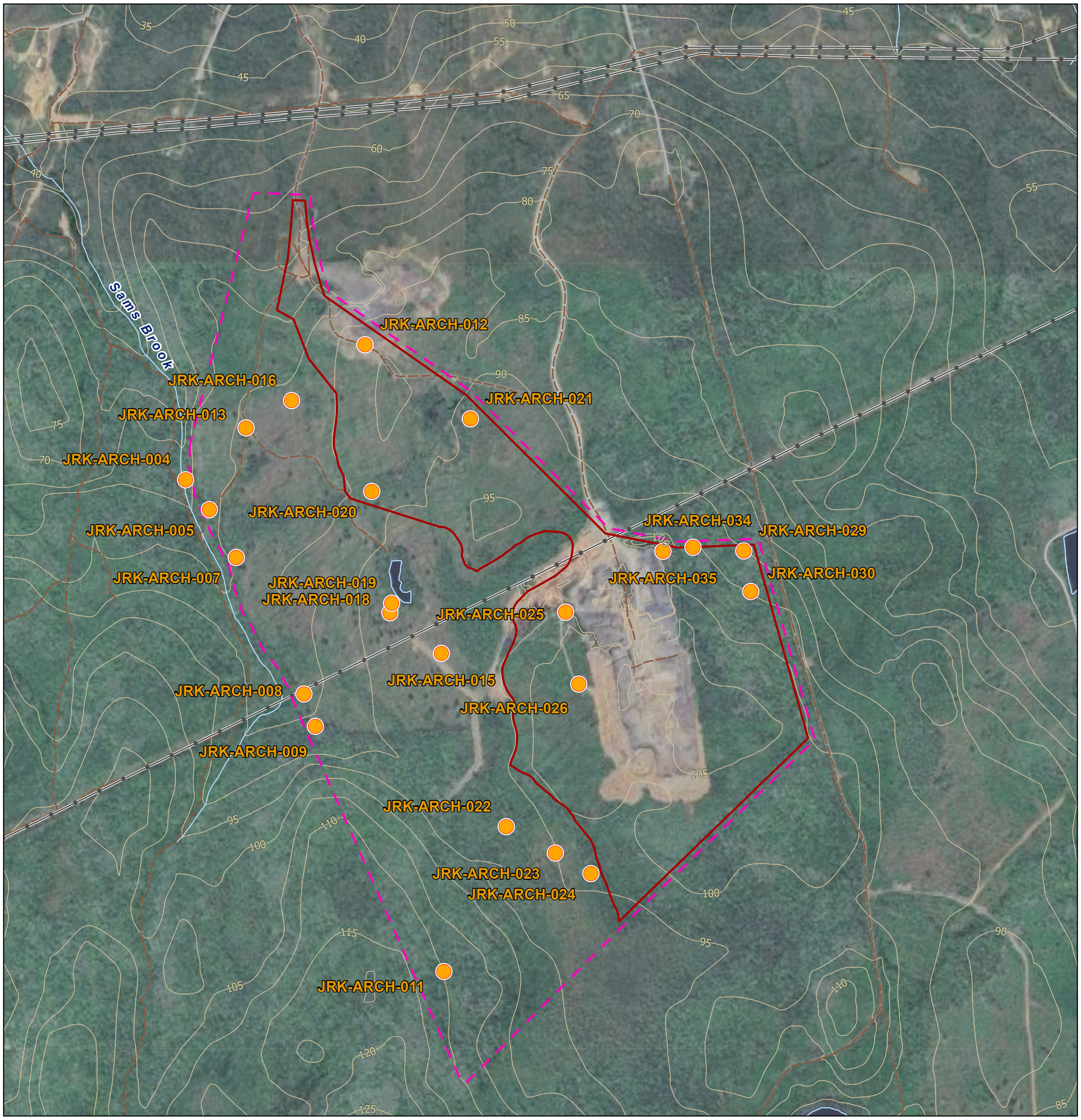
A significant residual adverse effect on heritage resources is defined as a residual Project-related change to heritage resources that results in unmitigated disturbance to, or destruction of, heritage resources considered by affected Mi'kmaq communities, other member of the public, and/or provincial heritage regulators to be of major importance due to factors such as rarity, condition, spiritual importance, or research importance. If heritage resources are present within the PDA, their integrity is highly susceptible to ground-disturbing activities since they are typically located on or in the soil or rock layers of the earth. Therefore, adverse interactions would be anticipated during site preparation as well as during operation during the quarry expansion as these are the phases of the Project where surface or sub-surface ground disturbance is anticipated.

The PDA (Figure 5.7.1) encompasses the potential areas of direct physical disturbance associated with the quarry expansion. Figure 5.7.1 also shows a larger Heritage Resources Survey Area (Survey Area) which shows the area that was surveyed for potential heritage resources before the current PDA was defined.

The LAA for the heritage resources is defined as the area within which the environmental effects of the Project can be measured or predicted. The LAA for heritage resources is limited to the PDA as it is only within the PDA that quarry expansion and ground-disturbing activities could interact with heritage resources. Heritage resources located outside of the Survey Area and PDA are discussed in the section 5.7.1 for local and regional context and to inform this assessment regarding the potential for unknown heritage resources to be located within the PDA. However, these resources (those outside the PDA) will not be directly affected by the Project and are not considered further in this assessment.

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of Nova Scotia provides guidance for conducting professional archaeological resource impact assessment (ARIA), such as the *Archaeological Resource Impact Assessment (Category C) Guidelines* (NSCCTH 2014) (the Guidelines).

Engagement activities have been ongoing as part of the heritage resources component of the Project. During the background research for heritage resources, regulatory agencies and Mi'kmaq organizations (i.e., Kwilmu'kw Maw-klusuaqn Negotiation Office's Archaeological Research Division [KMKNO-ARD]) were contacted in order to gather information on potential heritage resources within the Survey Area and PDA.



Project Development Area (PDA)
Heritage Resources Survey Area
Archaeology Survey
Archaeological Assessment Note (Stantec)
Other Features
Transmission Line
Local Road
Resource Road / Trail
Railroad
Contour (5m)
Watercourse
Waterbody

0 200 400 Metres
(At original document size of 8.5x11)
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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, OSM, Stantec
3. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Google

Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by SC on 2025-03-05
TR by MB on 2025-03-05

Client/Project
Spence Aggregates Limited
Spence Quarry
Expansion

121418141_012

Figure No.
5.7.1

Title
Archaeological Survey Results

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5.7.1 Existing Conditions

5.7.1.1 Approach and Methods

Information on the existing conditions (i.e., known information) regarding heritage resources was gathered through a combination of documentary research, consultation, and an ARIA conducted within the Survey Area in 2024. The ARIA was completed in compliance with the Guidelines. The ARIA was conducted by a permitted professional archaeologist under a Heritage Research Permit (HRP). A HRP application detailing the methodology to be employed for the Project's ARIA was submitted and approved by the Special Places division of NSCCTH.

Desktop historical background research was conducted for the Project using digital and archival information available from various government and non-government sources. The following sources of information were used to gather an understanding of the general and specific history of the general area, as well as the specific location of the Project, for both the Pre-Contact and Historic Periods:

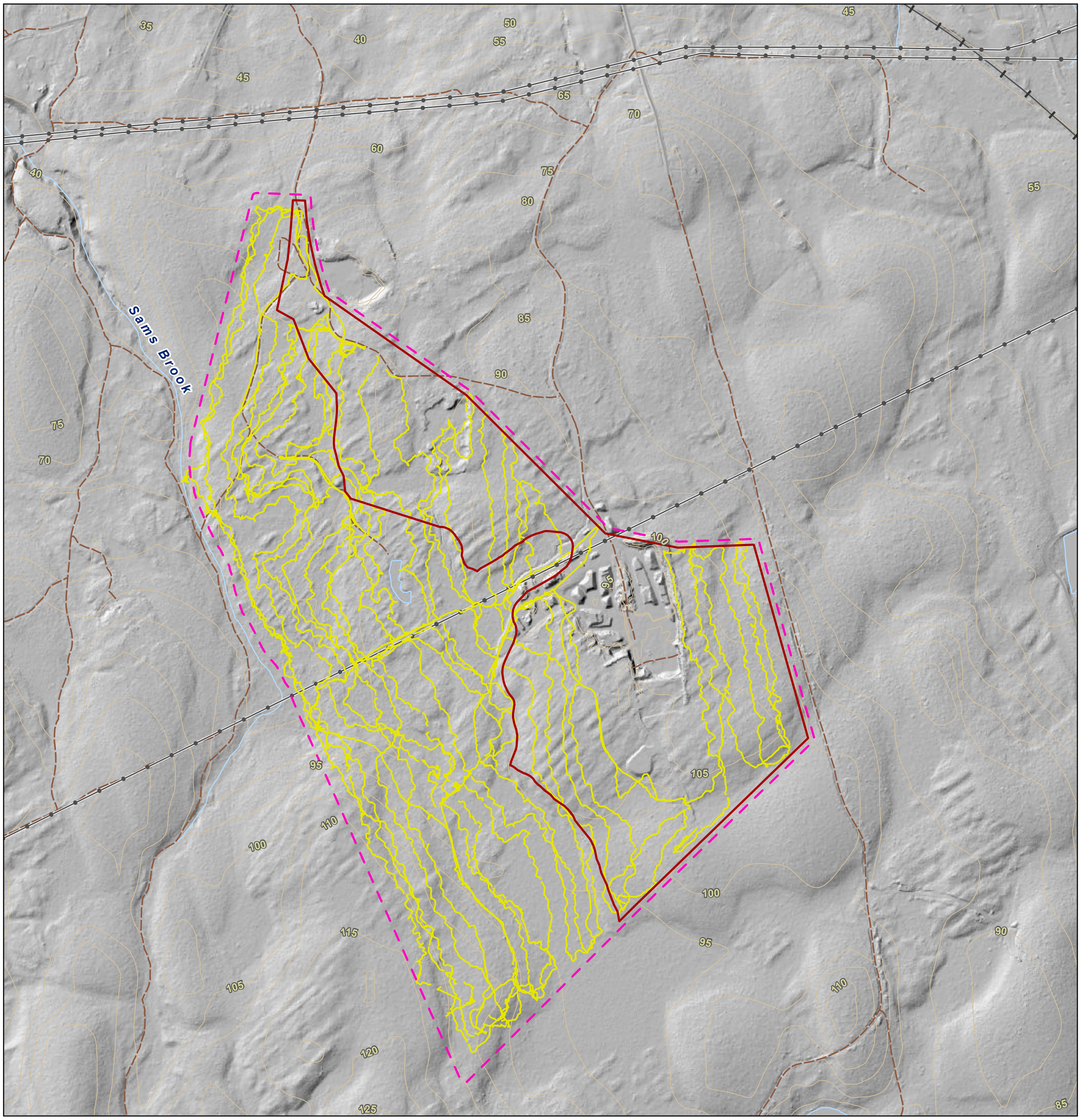
- Review of relevant Maritime Archaeological Resource Inventory (MARI) forms for information relating to recorded archaeological sites within a 1-km radius of the Survey Area
- Review of previous archaeological investigations conducted within or near the Survey Area through consultations with NSCCTH
- Review of historical maps and aerial photographs, maps, published sources, and historical and archival records of the Survey Area and adjoining properties to gain information on historical land use
- A review of the Canadian Register of Historic Places (CRHP)
- Engagement with the KMKNO-ARD to gather information pertaining to traditional or historical use of the Survey Area
- Review of Light Detection and Ranging (LiDAR) and base mapping of the subject property to identify environmental and physiographic features such as topography and historical water margins that would influence human settlement and resource exploitation patterns
- Knowledge of the Stantec Archaeology Team

The results of the historical background research were used to identify leading archaeological and environmental indicators for the potential presence of archaeological resources within the Survey Area. The results of the research are presented in section 5.7.1.3.

Following the historical background research, Stantec conducted a 'walkover' survey of the Survey Area, to identify, visually inspect, and document previously unknown heritage resources, and identify areas of elevated potential to contain archaeological resources. The walkover was completed via transects (0 - 30 m) through the Survey Area to assess ground and topographical conditions. The findings of the walkover were documented, taking into consideration the results of the desktop historical background study, and following the Guidelines as well as the experience, knowledge, and professional judgement of the Stantec Archaeology Team.

Assessment notes were taken as reference points during the walkover for discussion and recorded into Field Maps mobile phone application and labeled with the initials of the archaeologist and number of the assessment note (e.g., JRK-ARCH-###). Where areas of elevated archaeological potential were identified, these locations were delineated using a mobile mapping device and labeled as polygons, with the initials of the archaeologist, “POLY”, and the number of the polygon (e.g., “Polygon JRK-POLY-###”). During the walkover, surface-visible cultural features were noted and recorded, as appropriate. These locations were recorded and labeled as archaeological assessment notes, or as “historically significant features,” and labelled (e.g., “JRK-HSF-###”).

Field data were collected using a mobile phone device running Field Maps, a data collection and field mapping software developed by ESRI. Digital field maps were generated for the Project that combine relevant environmental and project data in GIS-based layers. A digital copy of data collected in the field is provided in the Survey Results (Figures 5.7.1 and 5.7.2). Additional field data collected using Field Maps included tracklogs and can be seen in Figure 5.7.2. The results of the walkover are detailed below.



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNOVA, NRCAN, OSM, Stantec
3. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada

Project Development Area (PDA)
Heritage Resources Survey Area
Archaeology Survey
Archaeological Tracklog (Stantec)
Other Features
Transmission Line
Local Road
Resource Road / Trail
Railroad
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Stantec

Project Location
Spence Quarry
Windsor, NS

Prepared by SC on 2025-03-05
TR by MB on 2025-03-05

Client/Project
121418141_013
Spence Aggregates Limited
Spence Quarry
Expansion

Figure No.
5.7.2

Title
Archaeological Survey Results

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5.7.1.2 Description of Existing Conditions

The sections below describe the existing conditions for heritage resources. Archaeological resources, built heritage, and palaeontological resources were considered when describing existing conditions as part of this VC.

5.7.1.3 Archaeological Resources

5.7.1.3.1 Previous Archaeological Resource Impact Assessments

A request was made with NSCCTH staff for any ARIA reports from previous assessments conducted within or near the PDA. Six previous ARIAs have been conducted near the PDA and are noted below.

An assessment report was located during background research for the Miller's Creek Quarry ARIA carried out in 2006 by CRM Group Limited (CRM Group) for Fundy Gypsum and was carried out to the north of the PDA. The work included a field reconnaissance, archaeological shovel testing with some test excavation. A Historic Period site and several other features were identified. Two recent reports provided by NSCCTH staff included two ARIAs completed by CRM Group which pertained to archaeological screenings for Wind Projects located to the southwest of the Survey Area. The Benjamins Mill Wind Project ARIA was carried out in 2001, followed by the Bear Lake Wind Project ARIA in 2022 (CRM Group 2022; 2023). The Bear Lake Wind Project had 12 areas of elevated potential identified and mostly were located within the northeast section of the study area near a watercourse. For the Benjamin Mills Wind Project, buffer zones were identified along a watercourse within the study area that contained elevated potential.

Another ARIA report for a wind project was carried out by Boreas Heritage Consulting Inc. (BHCI), in 2023 for the Ellershouse 3 Wind Project, located to the east of the Survey Area (BHCI 2023). Four elevated potential areas were identified for avoidance within the study area.

The most recent ARIA noted by NSCCTH staff was for the Hartville Quarry Expansion ARIA conducted in 2023 by Davis MacIntyre and Associates Archaeological Consulting (DMAC) (DMAC 2024). The Hartville Quarry ARIA was carried out to the east of the Survey Area. There were no archaeological sites or areas of elevated potential identified during the assessment and no further work was recommended.

5.7.1.3.2 Registered Archaeological Sites Near the PDA

A review of the NSCCTH MARI online database found that there are no registered archaeological sites within the PDA or Survey Area and two registered archaeological sites within a 5-km radius of the Survey Area: BfDa-01 and BfDa-11. BfDa-01 is situated along the west bank of the St. Croix River. The site was identified as the St.Croix Site (BfDa-01) and contains archaeological features dating to the Pre-Contact Period (Woodland and Archaic Periods) occupation or habitation site, first recorded by John Erskin in 1966, and later revisited and reregistered by Mike Deal in 1989 and 1990 (Earskin 1966; Deal 1989, 1990). The site boundary was increased after additional archaeological work on site by Memorial University in 2012 (Milner 2013, 2014). The site contains evidence of over 3,000 years of occupation, having assemblages from the Archaic to Ceramic Periods and being one of the most significant archaeological sites for the Maritime provinces (Deal 2016). The St. Croix Site is located approximately 2.3 km northeast of the Survey Area.

The second registered site, Panuke Lake I (BdDa-11), was identified in 2020 during an ARIA for Minas Basin Pulp (Garcin 2020). The site consisted of an artifact scatter identified along the shoreline of Lake Panuke and located approximately 3.8 km to the southeast of the Survey Area. Artifacts included some quartz and quartzite cores and flakes as well as four sherds of grit-tempered ceramics. The finds dated to the Woodland Period (Garcin 2020). The site was located along the eastern shoreline of Lake Panuke within the St. Croix Indian Reserve.

Both sites show presence of Mi’kmaw within the area and the importance of the St. Croix River system during the Pre-Contact Period. The lack of archaeological data for the area is due to limited archaeological research or assessment activity within the area, sea level rise over time affecting hydrology, recent historical land use and the damming of the St. Croix River that has caused fluctuations of water levels and impacted archaeological sites on its shorelines.

5.7.1.4 Cultural and Historical Background

5.7.1.4.1 Pre-Contact Period

During the Contact Period (500 BP- Present), the Mi’kmaq traditional territory included all of Nova Scotia and Prince Edward Island, parts of New Brunswick, the Gaspé region of Quebec, part of Maine, and southwestern Newfoundland. The PDA is situated in the district known as *Sipekne’katik*, which includes upper Cobequid Bay and much of central Nova Scotia, including the Truro area, much of the Annapolis Valley, St. Margaret’s Bay, and part of the Northumberland Strait. However, this history of occupation by the Mi'kmaq and their ancestors considerably pre-dates the Contact Period.

The earliest period of human occupation in Nova Scotia is *Sa’qewe’l L’nu’k* (the Ancient People) or “Palaeo-Indian” Period (12,000 – 8,000 BP), which saw the arrival of peoples who harvested caribou, possibly along with a variety of other fauna, following deglaciation of the region (Bonnichsen, Keenlyside and Turnmire 1991; Deal 2023). This Period is best represented in Nova Scotia by the Debert-Belmont site complex near Truro.

Sites of the following *Mu Awsami Kejihaw’k L’nu’k* (the Not so Recent People) or “Archaic” Period (8,000-3,000 BP), are characterized in part by distinctive ground stone tool industries. In Nova Scotia, sites of this Period are known primarily from interior locations, and for the most part date only to the latter half of this Period (the Late Archaic). Nevertheless, it is inferred that people were present in the province throughout this Period, and that their lifeways included a focus on harvesting the resources of the coast as well as interior waterways. The scarcity of evidence for occupation early in the Period and on the coast is thought to reflect the effects of rising sea levels; such sites now being situated in marine environments (Deal 2023; Kyte 2024).

The last phase of the Pre-Contact Period, *Kejihawek L’nu’k* (the Recent People) or “Woodland/Ceramic” Period (3,000- 500 BP), sees the appearance of ceramic technology in the context of wide-ranging interactions with other peoples of the greater northeast. Coastal archaeological sites are more clearly documented (albeit still threatened by rising sea levels and coastal erosion) and, in some cases, include substantial shell middens, indicating the harvesting of marine shellfish. Nevertheless, both marine and terrestrial resources figured in the seasonal round during this time, with some regional variation (Nash and Miller 1987; Davis 1991).

The Survey Area and PDA is within an area once part of a greater Mi'kmaw territory known as *Sipekni'katik*, meaning "Wild Potato Area" (Confederacy of Mainland Mi'kmaq 2007). The coastlines, islands, bays, harbours, and water systems would have been an important transportation route and resource base of the local Mi'kmaq and their ancestors. A research inquiry was submitted for the PDA with KMKNO-ARD and their review revealed five traditional ceremonial use sites within one kilometre of, but outside, the Survey Area. There are two Mi'kmaw archaeological sites within a five-kilometre distance of the PDA: BfDa-01 and BfDa-11 are recorded sites containing diagnostic lithics, ceramics, and flakes (KMKNO-ARD 2024). There is no known Mi'kmaw name for the area of the nearby Newport Station (Mi'kmaw Place Names Digital Atlas 2025). The name for the closest place nearby is St Croix Reserve IR 34 is *Panuk*, which means "at the opening," and the name for Falmouth is *Kwesawatqek*, meaning "thickly wooded point." The Mi'kmaw method for naming a place is verb based, frequently reflecting the meaning of the area to the Mi'kmaq, such as resources available or the landscape features of the area. This type of naming relies on an intimate understanding and repeated use of an area (KMKNO-ARD 2024). The PDA is located to the north of the contemporary St. Croix Indian Reserve No.34 (Nova Scotia Department of Natural Resources [NSDNR], Crown Record Sheet 54).

The Survey Area is also near a watercourse; regardless of size or velocity, watercourses are associated with heightened potential for encountering Mi'kmaw archaeological sites. Watercourses were used for navigation, drinking water, and harvesting areas and have been a significant feature of the Mi'kmaw cultural landscape since the Pre-Contact Period.

During the 19th century the local Mi'kmaw population were noted for traveling back and forth, coming up the St. Croix Lakes to the southern tip, portage their canoes a mile over the watershed to Timber Lake, paddle down to the west of Timber Lake and then portage another mile to Connaught Lake. They would then make their way down the Canaan branch of the East River and into the ocean. The continued use and presence of the Mi'kmaw were reference in an 1861 Petition for relief, stated there are 32 Mi'kmaq in encampment at Newport (KMKNO-ARD 2024). A reference was also provided where evidence was given from local informants that in addition to the archaeological evidence of Mi'kmaw fishing stations on the St. Croix River, on the South Branch of the Avon River at a place known as 'Indian Orchard' were local fish species (salmon and gaspereau) were likely harvested (KMKNO-ARD 2024). It appears the concentration or continued presence of historic Mi'kmaw were in the vicinity of Newport to the north of the Survey Area.

5.7.1.4.2 Historic Period

The Historic Period is defined as the period from the arrival of mostly European-derived peoples to North America, approximately 500 years ago, until the modern era. For Mi'kmaq communities, this Period is referred to as *Kiskukew'k L'nu'k* (Today's People) or Contact Period (500 BP- Present), which saw the growth of European settlement in the region, and with it, a variety of changes for *Kiskukew'k L'nu'k* associated with trade, conflict, and disease (Whitehead 1991).

The historic township of Windsor is situated to the northwest of the Survey Area in an area where the Avon River and St. Croix River fork apart within the central part of Nova Scotia. The township was laid out in a place known to the local Mi'kmaw as *Petikitk* meaning, "to flow split wise" and the area were Fort Edward (ca.1750) was known as *Pesliktik* (Mi'kmaw Place Names Digital Atlas 2025). The township was established in 1764 and named Windsor after the community of the royal family's residence in the United Kingdom.

Prior to the establishment of the township, the area was occupied by the Mi'kmaw during the summer months and later settled by the Acadians. The first recorded Acadian birth in the area was in 1684 and by 1714 when the area became apart of Nova Scotia, the population contained 337 Acadians (PANS 1967). In July of 1750, Fort Edward was built for the protection and a more effective control of the general area by the British. This was followed by the deportation of the local Acadian population between 1755 and 1758. The area was resettled by New England Planters after the area was opened for English speaking settlers in 1759. Settlement followed and by 1781 the townships of Falmouth, Windsor, and Newport were formed into the County of Hants (PANS 1967).

A group of New England Planters arrived in the Newport area by 1760, and by March of the following year the inhabitants petitioned for a distinctive township. Newport township was granted to 65 people and by 1763 there was approximately 245 persons settled around Newport Landing (PANS 1967) and located to the northeast of the Survey Area The township was named after Lord Newport, who was a friend of Jonthan Belcher, Lieutenant-Governor of Nova Scotia (1760 – 1763); prior to this time the area was known as east Falmouth. Jonathan Belcher was better known for negotiating the peace that led to the Burying the Hatchet ceremony in 1761 and was one of many ceremonies in which the Halifax Treaties were signed with the Mi'kmaw people ending years of conflict after the founding of Halifax in 1749.

The PDA is located within another township laid out opposite Windsor to the east and across the St. Croix River in 1762 (PANS 1967; NSDNR Sheet 54). The PDA is situated on one historic lot issued as part of the larger township issued to Jonathan Belcher et. al., granted in 1762 (Old Registry Book page 6B). The western end of the PDA is situated on a small section of the adjacent lot of 1500-acres, originally granted in 1765 to Anne Monk et. al., (Crown Records Book 7 Page 136), and is a lot situated along St. Croix River. The 1820 township map of Windsor had four surnames marked on segments of four lots (subdivision of Lot 6 and 7) that include Godfrey, Wilkins, lohn, and Judge (Anson 1820). The township developed primarily along the Halifax or Windsor Road (Route 1) during the 19th century, although the community of Newport Station did not come into existence until the railway was completed. Agriculture in various forms were the basic industry carried out in the areas around the PDA and by 1956 there were 463 people living within the community (PANS 1967).

Review of historic maps show no evidence of direct settlement within the PDA. On a 1737 map of Acadie wigwams are depicted in *Pesikitk* (Windsor) and showing the portage route 'chemin' that connected *Pesikitik* and *Kjipuktuk* (Halifax), meaning 'great harbour' (Mi'kmaw Place Names Digital Atlas 2025), via the St. Croix River system. No structures or settlements were depicted within the area of the PDA

There were no structures noted within the PDA on the Brewse's map of the '*Surveyed parts of Nova Scotia in 1756*' (Brewse 1756). Some structures are depicted along Route 1 to the north of the PDA on the township of Windsor map of 1820 (Anson 1820). On the A. F. Church map for Hants County, (Church 1873), structures are present along Route 1 as well as the railroad, and Newport Station is labelled. No structures were noted within the Survey Area on the 1909 Canadian Geological Survey map (Faribault 1909). A woods road is depicted running in a north-south orientation along the western edge of the PDA and into Newport, having some structures along the road although none within the Survey Area. The PDA is located within a quartzite boulder-swale-bog as seen in the geology map and would have been difficult to settle or cultivate due to surface conditions having frequent exposures of bedrock and undulating bouldery terrain. On the NSDNR land registry map of 1954 there is what appears to be a small watercourse in area of the small quarry in the north of the PDA and two wood roads running through the line up with aerial photos.

Review of aerial photographs revealed that most of the Survey Area was forested in 1945 (NSDNR 1945). The small quarry in the north is not present on the 1955 aerial (NSDNR 1955). Sometime before 1973 the small quarry in the north began operations and can be seen in aerial photos of that time (NSDNR 1973). The pond in the middle of the Survey Area also appeared in the 1973 aerial and was formed during the same time the small quarry in the north expanded. A quarry road from what is now Pleasant Street in Newport Station from the small quarry in the north of the PDA led south to the location of a possible cabin located to the south of a small pond, discussed below in section 5.7.1.5. The transmission line that bisects the middle of the PDA first appeared on the 1981 aerial photograph (NSDNR 1981). The hunting cabin identified during the walkover could not be seen in the 1981 and 1992 aerial photos, probably covered beneath the forest canopy (NSDNR 1992). The main quarry site in the southeast part of the PDA recently began operations sometime prior to 2010 when the quarry became visible on modern satellite imagery.

5.7.1.5 Field Examination

The field examination for the Project, conducted under Heritage Research Permit A20024NS119, was carried out over five days between July 8 to 11, 2024 and completed on July 15, 2024. The walkover of the Survey Area was conducted by walking transects having 0 – 30 m spacing to allow for proper coverage of potential impact areas. The results of the walkover, including assessment notes referenced in the text, can be seen in Figure 5.7.1. The tracklogs from the walkover are overlayed on a LiDAR hill shade rendering of the PDA in Figure 5.7.2 and the results of the survey are described below.

5.7.1.5.1 Walkover

The Survey Area was accessed from the north from Newport Station from Pleasant Street and transects were walked in a north-south orientation beginning from the small quarry. The forest conditions encountered consisted of a deciduous forest mixed with some pine trees and other softwoods. While walking south the terrain was found to be very undulating with frequent patches of exposed bedrock and stone mostly consisting of quartzite. Forest conditions change to mostly immature alder growth due to recent wood harvesting within the Survey Area further south. Once in the open area of a recent clearcut, the visibility increased to < 60 m in places while continuing south. A section of Sams Brook runs along the western side of the Survey Area and was encountered at assessment note JRK-ARCH-004 (Figure 5.7.1) and located just outside the Survey Area. The east side of the small watercourse has a low bank, and the watercourse is approximately 1-3 m wide. The watercourse is located outside the Survey Area and PDA. The terrain throughout was found to be very undulating and rocky, having frequent exposures of bedrock and poor soil development where the surface was exposed. The area along the small watercourse was found to be low in archaeological potential due to the rocky, undulating surface conditions observed and would have not been suitable for settlement or use during the Pre-Contact or Historic Periods.

Further south along Sams Brook the terrain slopes steeply to > 25° to the east up from the brook with the terrain continuing to be very undulating along the slope and having frequent exposures of surface rocks. A small drainage was encountered at assessment note JRK-ARCH-005, (Figure 5.7.1) which drained downslope, west into Sams Brook. The drainage was observed to run across the Study Area from a higher wet area in the east. While walking further south further into the Survey Area another recent tree harvested area was encountered. The visibility increased in places up to 60 m or more and the cut area contained random pine trees, as seen from assessment note JRK-ARCH-007 (Figure 5.7.1). Several tree throws were encountered within the open cut that were inspected, and no artifacts or features were notes. The tree throws showed that there is poor soil development and contained a great deal of stone (assessment note JRK-ARCH-008; Figure 5.7.1).

A woods road or trail was encountered in the southern section of the transect (assessment note JRK-ARCH-009; Figure 5.7.1) when entering back into the tree line. The forest consisted of an older growth mix wood forest with some larger pine trees. The terrain encountered to the south consisted of a boulder-swale and the steeply sloped (> 25°) downhill terrain. Along the western edge of the Survey Area within the southern forested section the visibility in places was greater than 60 m plus between the trees as they are thinned out more within this section. The terrain becomes low and wet in the southern section of the Survey Area as observed from assessment note JRK-ARCH-011 (Figure 5.7.1). The transect was then offset to the east and walked north and encountered the woods road and continued north to the transmission line that bisects the Survey Area and PDA in a southwest-northeast orientation. The transmission line was found to be mostly open although a low wet grown in section was walked over before encountering the existing quarry.

The Survey Area was then traversed in a south-north transect from the smaller quarry in the north, accessed from a quarry road at assessment note JRK-ARCH-012 (Figure 5.7.1). The survey crew began by walking over the northwest section of the PDA around the small quarry. The area was generally clear of trees with some immature alder growth patches. Visibility was > 100 m in places. The area was found to have been heavily impacted from prior quarry activity. Further south another quarry road was encountered at assessment note JRK-ARCH-013 (Figure 5.7.1). The transect was traversed south and the survey team carried out another transect to the east and walked north through the Survey Area to the transmission line. The crew then offset to the east and made another transect south. A deer stand was located close to a quarry road at assessment note JRK-ARCH-015 (Figure 5.7.1). The transect ended in the south at the edge of the Survey Area. The survey crew then walked a woods road west, then north, to end back at the main quarry. Overall surface conditions remained consistent: a boulder barren, that was very rocky, had poor surface soil development, undulating terrain, as well as some area being low, wet forested swampy bog areas and determined to have low potential for archaeological resources.

Another transect was walked over beginning from the existing quarry footprint. While walking south forest conditions change from an immature alder growth to an open cut at assessment note JRK-ARCH-016 (Figure 5.7.1) and continued south and the survey crew stopped at the transmission line and traversed to the east and then walked another transect north. A wooden outhouse was encountered at assessment note JRK-ARCH-018 (Figure 5.7.1) and the remains of a burnt-out 20th century hunting cabin encountered at assessment note JRK-ARCH-019 (Figure 5.7.1). The camp contains a small quartzite slate stone lined sill foundation, measuring approximately 12 ft x 12 ft (3.7 m x 3.7 m) and constructed with a sheet corrugated steel roof. Remains of the bed, stove, and other food related kitchen items, propane tank, old car battery, knives, shovel heads, axes, abraders, etc., all appeared to date to the mid to later half of the 20th century and do not appear to be historically significant. The front of the cabin once faced a small pond located approximately 20 m to the northeast at assessment note JRK-ARCH-019 (Figure 5.7.1), The cabin appeared to be in context with the deer stand and the outhouse previously encountered. The pond still contained some saved pine trees around it and an old trail was observed leading from the front of the old cabin north along the pond to a woods road that that leads to the small quarry in the north of the PDA.

Heading north from the remains of the burnt-out cabin along the small pond through the clearcut, the bog was encountered again that is part of the drainage running from a small pond located to the northeast of assessment note JRK-ARCH-020 (Figure 5.7.1), flowing west to Sams Brook. The survey crew then followed the exposed ridge of bedrock west from a lower wet area at assessment note JRK-ARCH-021 then turned south and walked another transect south to the transmission line then one additional transect was walked to the north ending at the main quarry. The terrain and conditions continued to be very harsh, and no areas of archaeological potential were identified.

The eastern side of the northern section of the Survey Area was then walked over from the quarry road south across the open cut through the low wet drainage area and to the transmission line. Forest conditions encountered in the south consisted of a mix of immature coniferous with some deciduous trees and was found to be low and wet. There were signs of past forest harvesting activity encountered, and a woods road was located at assessment note JRK-ARCH-022, (Figure 5.7.1) while walking south. Conditions became boggy in the southern section of the Survey Area at assessment note JRK-ARCH-023 (Figure 5.7.1). After completing the transect south another transect was offset to the east and walked north from the bottom of the Survey Area. In the south the forest conditions changed to mostly immature conifer forest mixed with some pine trees. The terrain is sloped > 20° to the east at assessment note JRK-ARCH-024 (Figure 5.7.1). The survey crew then continued north, back to the quarry road in the middle of the Survey Area. The crew then offset to the east and followed another transect south along the quarry from assessment note JRK-ARCH-025 (Figure 5.7.1). While walking south another quarry road was encountered at assessment note JRK-ARCH-026 (Figure 5.7.1) and it was encountered again while walking another transect north. While walking north, the edge of the existing quarry footprint was encountered and the transect continued to the north ending at the main quarry parking lot. There were no areas of elevated potential identified or traces of significant historical occupation or use in the areas assessed in this area of the Survey Area or PDA.

The last section of the Survey Area walked over was the small area to the east of the existing quarry in the south. Entering from the transmission line walking south, forest conditions consisted of mostly immature coniferous forest mixed with some older pine and other hard wood trees. The terrain has a slope > 20° to the south and was found to be very undulating with frequent hummocks and exposures of surface stone and poor soil development (assessment note JRK-ARCH-029) (Figure 5.7.1). A woods road was encountered at assessment note JRK-ARCH-030 (Figure 5.7.1) and evidence of recent skidder activity and tree harvesting activities were observed. At the southern end of the transect the crew offset to the west and walked another transect north. Past tree harvesting activity was observed where several skidder trails were encountered. A tree throw was investigated and showed the underlying rocky terrain with poor soil development at assessment note JRK-ARCH-034 (Figure 5.7.1). There were no artifacts, features and or deposits located in any of the tree throws investigated. The area to the south and east of the existing main quarry was found to be low in archaeological potential and there are no recommendations for additional investigation.

The crew walked one more transect to the south along the eastern side of the main quarry from assessment note JRK-ARCH-035 (Figure 5.7.1) where an old quarry road was walked over to the south, to the end the proposed new quarry. Surface conditions remained the same, the forest consisted of some older pine trees mixed with mostly immature conifer trees with patches of immature alder growth in less forested sections and having some other hardwood trees like birch and maple. There where no areas of elevated potential identified or traces of past historical occupation or use. Aside from some modern 20th century use of the Survey Area for hunting, forest harvesting, and from recent quarry activity, the Survey Area and the PDA are found to be low in potential for containing archaeological resources dating to both the Pre-Contact and Historic Periods.

There were no significant heritage resources identified within the Survey Area of PDA, and the PDA as a whole was found to have low potential for archaeological resources due to surface conditions encountered during the field assessment, as described above. The PDA would not have been desirable for settlement and or use during the Pre-Contact and Historic Periods due to sever topographical and ground surface conditions. Evidence of recent 20th century use of the PDA for tree harvesting and hunting were observed but are not considered historically significant. There are no recommendations for further archaeological assessment in the PDA. If the current footprint of the PDA changes beyond the limits investigated in this section (i.e. the Survey Area), then it is recommended that additional archeological surveys be carried out to assess these additional areas not covered within this assessment.

5.7.1.6 Built Heritage Resources

A review of the Canadian Register of Historic Places (CRHP) (2025) identified no registered historic places or heritage sites located within 5 km of the PDA. The closest concentration of registered sites is located within Windsor, NS consisting of such sites as Kings College and Fort Edward National Historic Sites. No other historic places or buildings were found near or within the PDA during the background review. Therefore, potential adverse environmental effects of the Project on built heritage resources will not be considered further.

5.7.1.7 Palaeontological Resources

While no specific palaeontological report was prepared and no fieldwork with respect to palaeontological resources was required during assessment of the Project, the potential for palaeontological resources to be affected by Project activities is low. The Survey Area is located within the Quartzite Barrens Theme Region (Theme Region 413a) as detailed in *The Natural History of Nova Scotia, Volume Two, Theme Regions* (Davis and Brown 1996). There are large areas of exposed rock where the till was scraped off by glacial ice within the area south of Newport Station. The bedrock-dominate topography for these barrens is described as “ridge-swamp-swale” where greater thickness of glacial till has accumulated in drumlins (Davis and Brown 1996).

Most of the Survey Area is covered by Halifax soils, which are well drained, stony, sandy loams that developed on till derived principally from quartzite. Dansville soil occurs in areas of low relief and is poorly drained. Some Bridgwater soils, derived from slates, are also present (Davis and Brown 1996).

A review of published maps shows that the Survey Area is located almost entirely on bedrock comprised of quartzite with no deposits potentially containing fossil remains (Keppie 2000). Therefore, potential adverse environmental effects of the Project on palaeontological resources will not be considered further.

5.7.2 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Heritage Resources is provided in Table 5.7.1. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.7.1 Potential Effects, Effect Pathways and Measurable Parameters for Heritage Resources

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Heritage Resources	• Excavation resulting in surficial or subsurface ground disturbance	• Presence or absence of a heritage resource

Potential interactions with heritage resources could occur during activities that involve surface and subsurface ground disturbance. For this Project, that includes the clearing and grubbing and the operation and maintenance phase of the Project as groundbreaking activities will be taking place for the life of the Project. The following activities during quarrying have the potential to interact with heritage resources:

- Clearing and Grubbing
- Any excavation of surface soils in previously undisturbed areas down to glacial till

These activities will take place as part of the operational phase of the Project, as there is no “construction phase” of the Project, per se.

5.7.3 Mitigation and Management Measures

The following mitigation measures specific to Heritage Resources have been identified for the Project:

- Develop and implement a Heritage Resources Accidental Discovery Plan in the unanticipated event that heritage resources are discovered during the operation of the Project.
- Contact NSCCTH’s Special Places Coordinator and/or the paleontological staff at the Nova Scotia Museum to develop appropriate mitigation should any significant heritage resources be discovered during Project activities.

5.7.4 Residual Environmental Effects

As noted in section 5.7.1.5, no heritage resources were identified during the archaeological field survey of the Survey Area and PDA and the Survey Area and PDA were characterized as exhibiting low potential for sub-surface heritage resources. With the implementation of the mitigation described in section 5.7.3 (i.e., implementation of a Heritage Resources Accidental Discovery Plan), residual adverse environmental effects on archaeological resources are not anticipated. There is no anticipated interaction between built heritage and paleontological resources. Project-related residual effects on heritage resources are therefore predicted to be negligible and not significant.

5.7.5 Follow-up and Monitoring Programs

There are no recommendations for further archaeological assessment in the PDA. If the current footprint of the PDA changes beyond the limits investigated in this ARIA, then it is recommended that an additional ARIA be carried out to assess these additional areas not covered within this assessment.

A dedicated follow-up and monitoring program is not proposed for Heritage Resources.

6 Effects of the Project on Indigenous Communities and Activities

This section discusses the potential effects of the Project on Indigenous communities and activities throughout the life of the Project. This section does not include scope related to indigenous engagement (section 4), or general effects of the Project on valued components unless these are anticipated to directly effect Indigenous communities or their activities. For more generalized effects of the Project, see the applicable VC in section 5.

6.1.1 Effects on the Mi’kmaq of Nova Scotia

Project with ground disturbance have inherent potential to affect surrounding landscapes and land uses. For the purposes of this section, an effect of the Project on the Mi’kmaq in Nova Scotia is defined as the loss or alteration of access to lands used for traditional purposes, where these activities are known or expected to occur.

There are currently no known traditional land uses in the PDA or surrounding lands, and lands are not generally easily accessible through off-road routes. There are a few access points to lands in the vicinity of the quarry (e.g., the transmission line in the center of the PDA) which could potentially facilitate access to the land, however, these routes are signed, and transportation along them is discouraged. While the Project inherently has potential to directly affect Mi’kmaq activities, these direct effects are not anticipated.

Indirect effects to indigenous activities could occur as the Project could act as a barrier restricting access to previously accessible lands. The potential for these indirect effects is also considered low due to the history of quarry activity in the area, and the difficulty already available in accessing land through the PDA.

Overall, it is not anticipated that the Project will have effects on Indigenous communities.

6.1.2 Mitigation for Unanticipated Effects

Mitigation and monitoring outlined for VCs discussed in section 5 are expected to help mitigate the likelihood of unanticipated effects of the Project on Indigenous communities. Specifically, mitigation and management related to the potential discovery of heritage resources, including those of interest to Indigenous communities, are discussed in section 5.7.

6.1.3 Ongoing Mi'kmaq Engagement

While effects on Indigenous communities are not anticipated, Spence Aggregates recognizes the importance of ongoing communication with Indigenous groups. An Indigenous Communications Plan will be developed to share progressive updates regarding the Project with Indigenous groups. The plan will outline the minimum communication requirements but Indigenous communities are invited to comment on the Project at any time.

7 Other Undertakings in the Area

Under section 12 of the NS Environmental Assessment Regulations, the Minister must consider other undertakings around proposed projects registered as a Class 1 Undertaking. Environmental effects associated with other nearby undertakings may potentially act in combination with the environmental effects of the Project. Potential environmental effects and a discussion of the potential for other undertakings to act in combination with environmental effects of the Project are noted below.

Generic potential environmental effects from quarry operations include:

- Dust, noise, and light emissions from quarrying and associated traffic
- Loss/alteration of wetland areas due to site activities (e.g., erosion, sedimentation)
- Loss and/or change in terrestrial habitat including a direct effect on SAR and/or SOCC in the area through direct disturbance or by causing indirect changes to their habitat resulting in a loss of individuals or change in species abundance or distribution
- Change in recreational and/or traditional land and resource use (e.g., loss or impeded access)

Alva Construction Ltd. owns a quarry (Hartville Quarry) located approximately 2 km east of the PDA that has recently been approved for expansion up to 10.118 ha. Approximately 5 km to the west of the PDA is the Nova Windsor Quarry based on available mapping; however, no information was readily available regarding operations. There is a large, decommissioned gypsum mine approximately 4 km north of the Project. The mine used to be operated by the Fundy Gypsum Company but closed permanently in 2011. A review of desktop mapping suggests there are several other pits and small quarries, including some that are inactive, in the vicinity of the Project. These operations, including the existing Spence Aggregates Quarry, have been operating for a number of years.

The existing Spence Aggregates operation is currently functioning without any major issues with respect to dust, emissions, traffic, or water. If concerns are reported, Spence Aggregates will address them immediately. It is assumed that quarries and mining operations in the region are obligated to abide by standard permit conditions to manage noise, dust and other emissions that could potentially overlap with mining operations at the Spence Aggregates site.

Since the Project does not include an overall increase in production, and assuming the effective application of mitigative measures at the Project site, and for other projects operating under provincial approval, significant adverse cumulative type effects resulting from the Project and other undertakings in the area are not likely to occur. No changes are predicted as a result of the Project with respect to cumulative noise or dust to local communities given that Project operations will not increase in intensity. While the Project can result in adverse environmental effects, these effects will be managed through the implementation of mitigation measures identified in this assessment, thereby reducing the Project's contribution to potential cumulative effects with other undertakings. The Project is not predicted to affect the existing undertakings described above.

Since the Project is not expected to result in an increase in operational activity or traffic, residual adverse effects from the Project are not predicted to contribute to existing adverse effects from other undertakings, beyond a cumulative loss of habitat. The Project will involve progressive reclamation of habitat and effects on habitat are expected to be reversible in the long term. It is anticipated that other future undertakings will be required to implement similar mitigation measures and standards, further reducing potential for other undertakings to contribute additional adverse effects. The Project and other resource undertakings in the region will combine to create economic benefits locally, regionally and provincially as well as providing critical construction materials for provincial development projects.

8 Effects of the Environment on the Undertaking

For quarry projects, effects of the environment on the Project include a change to the Project caused by the environment, usually related to climate and meteorological conditions.

NSECC's *Guide to Considering Climate Change in Project Development in Nova Scotia* (NSE 2011), notes it is important to understand the effects associated with climate change to reduce Project risks by complying with existing and future GHG reduction targets and legislation in Canada by considering their 'carbon footprint'.

Normal temperature and precipitation conditions are not expected to have substantive effects on the Project. Potential climate change events may affect Project operation in several ways. Events that could result in adverse residual environmental effects include increased frequency of extreme storms accompanied by strong winds, increased incidence of flooding and erosion, increased frequency of heavy precipitation events, and increased risk of wildfires. Each of these events, if not designed for, could result in infrastructure damages that are not feasible to fix, or failure of mitigation measures, which may in turn result in adverse environmental effects.

Heavy precipitation events can increase the risk of erosion and sedimentation and can temporarily restrict Project activities. Occasional heavy precipitation events are expected, and the quarry operation schedule allows for weather conditions typical for the region. Erosion and sediment control measures will be updated during the IA amendment stage.

Heavy precipitation events (including snow accumulation) may cause short-term delays during operation of the Project, however, are not anticipated to result in long-term environmental effects. Heavy precipitation will result in increases in stormwater runoff in the Project Area, resulting in increased loadings to the stormwater collection mechanisms. Required changes to existing stormwater management measures will be evaluated and implemented at the IA amendment stage. Design criteria will recognize the increased likelihood of intense precipitation events in coming decades.

Rising temperatures and drier conditions as a result of climate change may increase risk of wildfires. The increase of fire risk with climate change within northeastern Canada is moderate (Whitman et al., 2015). The Project is not likely to sustain damage from potential wildfires due to the lack of organic matter as fuel, but forests adjacent to the quarry and along access roads could be hazardous to Project operations during an active wildfire. Wildfires are not expected to result in substantial damages to the Project but could result in an interruption of Project operations.

Earthquakes are a non-climate related natural phenomenon that has the potential to affect the Project, though risk of earthquakes is low within Nova Scotia. Earthquakes could affect the structural integrity of the quarry slopes and would therefore be most hazardous to operations and equipment. Given the low risk, significant damages are not expected to occur.

There are several planning, design, and construction strategies that can mitigate potential effects of the environment on the Project to lower risk of damage to the Project or interruption of operation. Mitigation measures include, but are not limited to, designing, and installing erosion and sediment control structures to accommodate high levels of precipitation, and considering weather conditions and forecasts when scheduling activities.

Project activities will be taking place out-of-doors and normal and extreme weather events have been considered in existing quarry operations and proposed Project activities. In summary, the effects of the environment on the Project as a result of climate and meteorological conditions, including climate change, will be not significant.

9 Other Approvals and Applicable Plans

9.1 Other Approvals

Spence Aggregates will obtain all required authorizations prior to undertaking activities for which those authorizations are needed. In addition to the registration as a Class I Undertaking pursuant to the *Environment Act* and Environmental Assessment Regulations, other relevant approvals include the amendment to the existing IA (No. 2007-056319-02) and a Wetland Alteration Approval under the Activities Designation Regulations.

9.2 Applicable Plans and Commitments

Spence Aggregates has an active Rehabilitation Plan that will be updated as a result of the Project IA amendment. Spence Aggregates is also committed to creating additional plans committed to in this EARD including:

- Environmental Management Plan
- Wetland Monitoring Plan
- Heritage Resources Accidental Discovery Plan
- Indigenous Communications Plan
- Public Communications Plan

These Project-specific plans will be completed in conjunction with the IA amendment for the Project.

Spence Aggregates also commits to the monitoring of blasts by a qualified blasting professional. Monitoring of air and/or noise emissions will be completed at the request of NSECC, and in accordance with IA terms and conditions.

10 Funding

The Project will be 100 percent privately funded.

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